



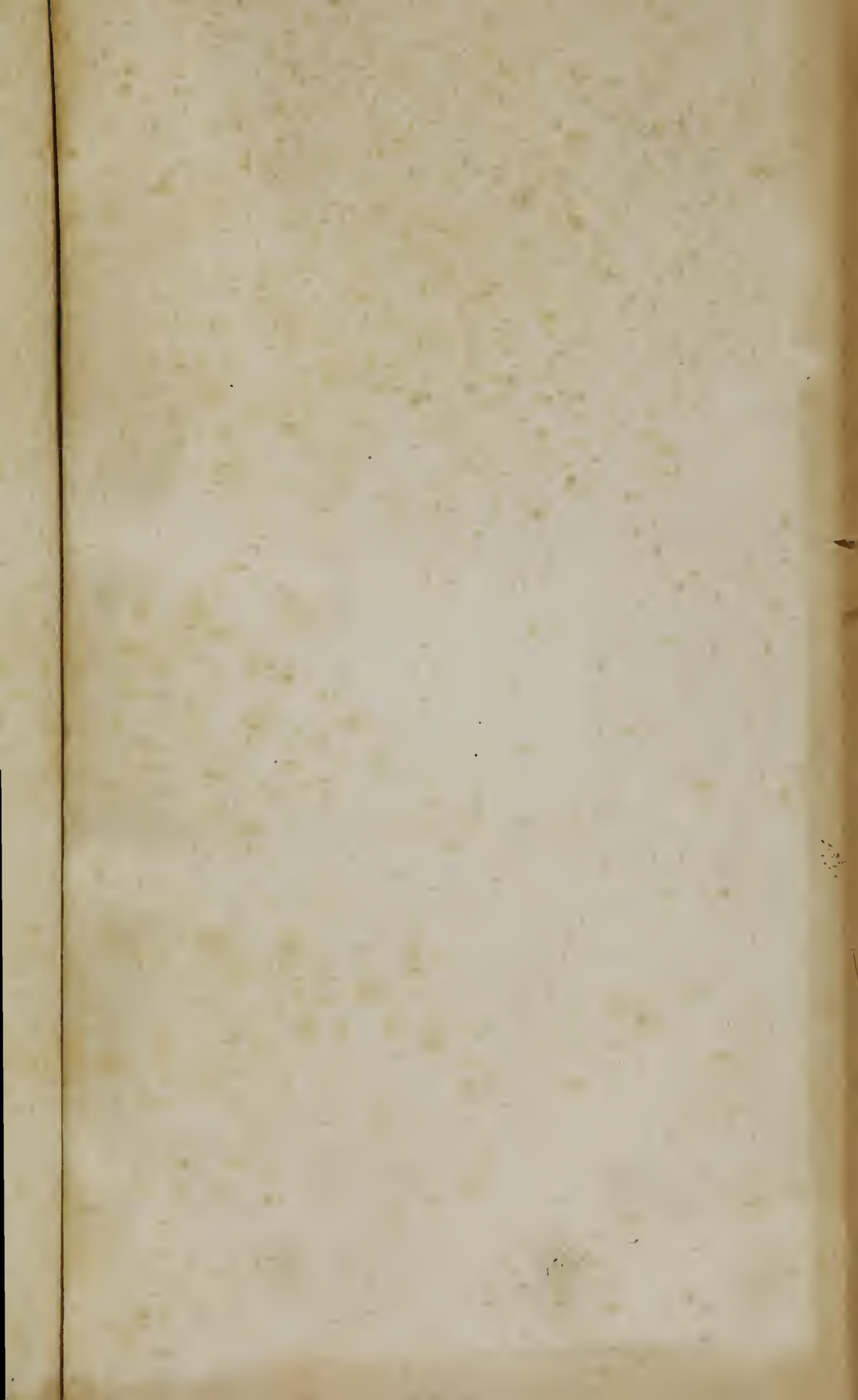
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*W. R. O. Abbott*

ELEMENTS  
*from his friends & preparation*  
OF  
*Casper Morris*  
PATHOLOGICAL ANATOMY;

ILLUSTRATED BY

COLORING ENGRAVINGS AND TWO HUNDRED AND FIFTY  
WOODCUTS.

---

BY SAMUEL D. GROSS, M.D.,

PROFESSOR OF SURGERY IN THE MEDICAL INSTITUTE OF LOUISVILLE;  
LATE PROFESSOR OF PATHOLOGICAL ANATOMY IN THE MEDICAL DEPARTMENT OF THE  
CINCINNATI COLLEGE;  
SURGEON TO THE LOUISVILLE MARINE HOSPITAL, ETC., ETC.

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SECOND EDITION, THOROUGHLY REVISED, AND GREATLY ENLARGED.

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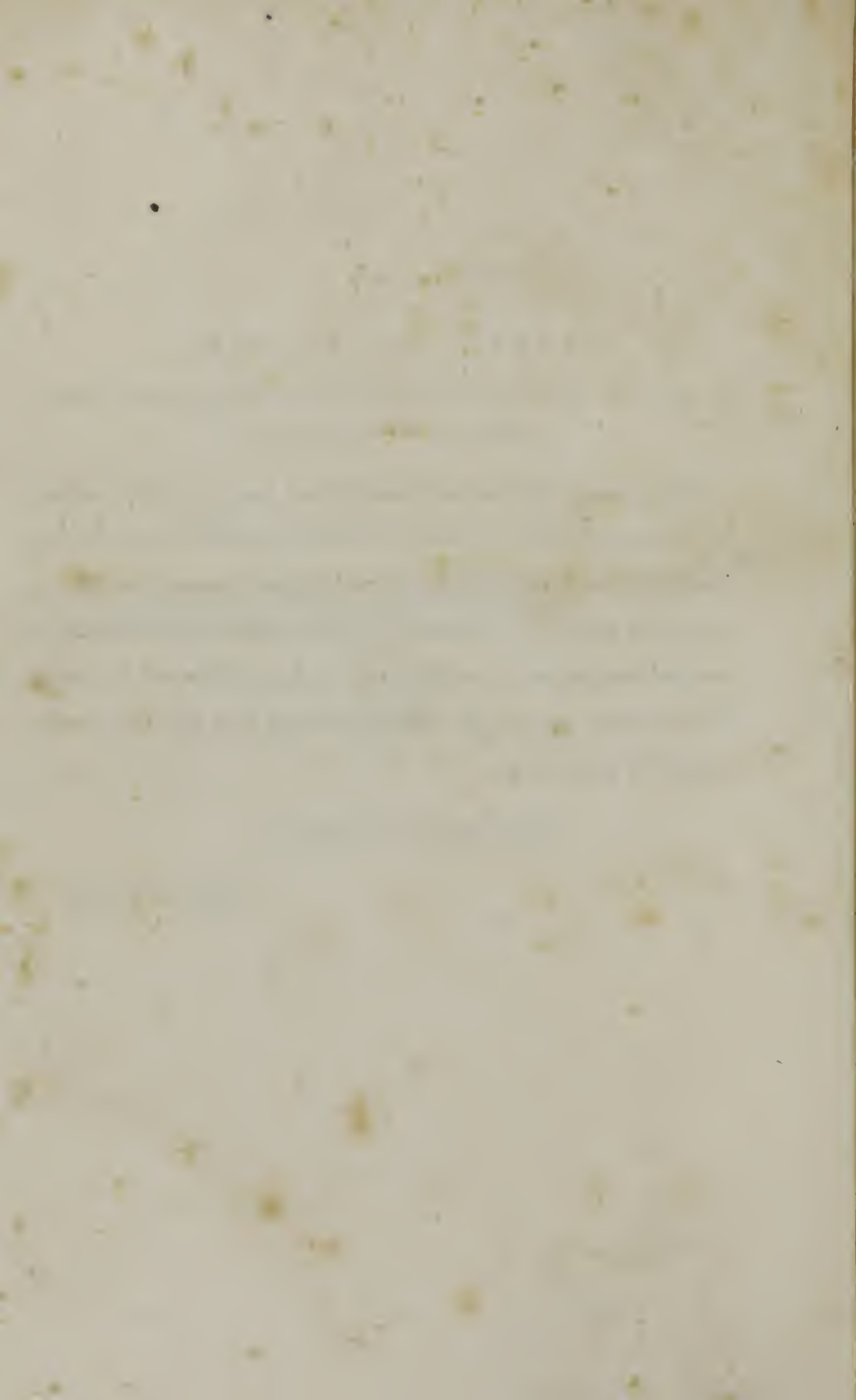
PROFESSOR OF PATHOLOGY AND THE PRACTICE OF MEDICINE IN THE MEDICAL  
INSTITUTE OF LOUISVILLE, ETC., ETC.,

Distinguished alike as an accomplished and successful teacher, an erudite and skilful physician, a zealous promoter of science and literature, and an ardent friend of pathological anatomy, the following pages, intended to illustrate one of the fundamental branches of medical science, are respectfully inscribed, as a testimony of esteem for his exalted talents and attainments, and as a token of sincere regard for his character,

By his Friend and Colleague,

THE AUTHOR.





# P R E F A C E

## . TO THE SECOND EDITION.

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THE present edition of this work has been thoroughly revised ; many parts have been re-written ; and an amount of new matter equal to three hundred pages of the original has been introduced. The number of illustrations has been increased from ninety-seven to nearly two hundred and fifty. Of these about one-third are original ; the remainder have been selected from various sources, as Laennec, Carswell, Müller, Gerber, Lobstein, Gulliver, Marcet, Cooper, Curling, and Cruveilhier. The work, in its present form, is believed to exhibit an accurate and comprehensive view of the science of which it treats. For the sake of greater convenience, as well as that of cheapness, it is comprised in one instead of two volumes. The author regrets that, in the preparation of this edition, it has not been in his power to consult the admirable treatises on Pathological Anatomy by Vrolik, Hasse, and Rokitsansky.

MEDICAL INSTITUTE OF LOUISVILLE,  
*October 1, 1845.*

# PREFACE

## TO THE FIRST EDITION.

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THE acknowledged want, in our country, of a work on pathological anatomy precludes the necessity of any apology, on the part of the author, for offering to the profession the following publication. The only native production of the kind, which has yet appeared, is the Treatise of Professor Horner, of the University of Pennsylvania, which, from the narrow limits within which it is restricted, can lay no claim to the character of a system, or be considered as exhibiting a correct view of the existing state of the science, reformed, as it has recently been, by new discoveries and improvements. As presenting a record of facts, collected with indefatigable industry, and detailed with great candor and impartiality, it is a valuable fund of information, which can never be consulted without interest and instruction.

Of foreign works that have found their way to the United States there are only two, those of the late Dr. Matthew Baillie, of London, and of Professor Andral, of Paris. Concerning these productions, which are both highly honorable to their authors, as well as to the nations to which they respectively belong, it need only be remarked that the one, besides being entirely out of print, is altogether in arrear of the present condition of pathological anatomy; and that the other, from the introduction of new and perplexing terms, for which there is such an extraordinary fondness on the part of the French writers, and from a singular want of systematic arrangement, can never subserve the purposes of a text-book. To supply these deficiencies, therefore, is the object of the present treatise.

It has been the constant aim of the author, in the composition of the following pages, to express himself in plain, intelligible language, to abstain from every thing like pedantry, in the use of new terms, and to furnish, as far as practicable, a comprehensive view of the existing state of the science. How far he has succeeded, in these and other respects, he leaves to the candid judgment of his reader to determine. It is sufficient to say that he has been fully sensible of the responsibility of the enterprise, and that nearly four years have been devoted to its accomplishment.

In regard to his materials, the author may be permitted to state, that, whilst he has freely availed himself of the usual sources of information from books, as every one who wishes to present any thing like a connected view of the science necessarily must, he has not omitted, whenever occasion offered, to incorporate the results of his personal observation and experience. Although much less extensively engaged in necroscopic examinations than many of his European brethren, or even, perhaps, than some of his more immediate neighbors, his former position, as Professor of Pathological Anatomy in the medical department of the Cincinnati College, gave him unusual advantages, and induced him to devote a much greater share of attention to the subject than is ordinarily allotted to it. The average period he is in the habit of spending upon such dissections is from two to three hours; and it has been his constant practice, moreover, for many years, to carry away, for subsequent and more thorough inspection, every morbid structure of interest. In this manner has been formed the nucleus of a museum of pathological anatomy, embracing a large number of the most valuable specimens.

It is certainly an anomaly in the history of our profession, that a science which admits of such extensive application as the present, and which may be regarded as constituting the very foundation of medicine, should still be so much neglected as a branch of elementary study in the United States. This is so much the more surprising when we consider the successful efforts which have been made, of late years, for the diffusion of general knowledge, and the absolute importance, in a pursuit like ours, of availing ourselves of every source of information, whether of a direct or collateral bearing. It displays, to say the least, a degree of apathy on the part of our schools, which is alike disreputable to them as seminaries of learning, dis-

graceful to the American profession, whose dignity and usefulness they ought to have at heart, and injurious to the progress of medical science.

The utility of an extended knowledge of this science cannot, indeed, be any longer a matter of doubt or dispute. Without the light which it furnishes, our views of disease must necessarily be limited and confused; whilst, by its help, the nature and seat of every lesion are comparatively easily comprehended. The history of pathological anatomy may be said, not unaptly, to be a register of observations, not of a single individual, but of many, to ascertain the power of morbid action; and precisely in proportion as they are based on fact, is their tendency to advance the healing art to the rank and dignity of a certain science. From the successful manner in which they have been conducted within the last twenty years, and from the immense flood of light which they have shed upon the nature, seat, and diagnosis of disease, it is obvious that they alone can yield any substantial trophies; and they should therefore at once serve to guide and encourage our future researches. To discriminate between different lesions; to be able to locate, or give them "a habitation and a name;" to know the nature of their products and their effects, — these are some of the qualities which distinguish the medical philosopher from the routine practitioner, the scientific physician from the mere symptomatologist.

It is certainly a matter of deep regret that the investigation of diseased structure was not conducted in a more diligent and enlightened manner by our medical ancestors: had this been done, comparatively little would have remained to be accomplished by the present race of physicians: diagnosis, the grand object of our preparatory studies, would be much more perfect, and the fundamental principles of our profession would repose upon a more firm and immutable basis. But, as it is, our heritage unfortunately amounts to little else than a detail of individual facts, drawn up, for the most part, in so loose and slovenly a manner as to render it difficult, if not impossible, to derive from them any profitable results.

The appearance of Bichat, towards the close of the last century, on the great theatre of active life, constitutes a new epoch in the history of medicine, pregnant with the most important events. From the thorough revolution which has been effected by his writings, in the total subversion of the various artificial systems of nosology which flourished up to the period adverted to, we may justly award to him the honorable and well-merited title of the "father of modern pathological anatomy;" and to his influence and example, more than to those of any other individual or sect in medicine, are unquestionably to be ascribed all the discoveries and improvements which have been achieved, in different quarters of the civilized world, since the time in which he wrote. The admirable works of Laennec, Bouillaud, Louis, Andral, Cruveilhier, J. F. Meckel, Abercrombie, Hope, Mayo, and Carswell, are all traceable, directly or indirectly, to the extraordinary impulse transmitted by this illustrious man: they are enterprises of the highest utility to medicine, and they afford a happy illustration of the spirit of inquiry and philosophy which actuates the physicians of the age in which we live.

It will be perceived that considerable space is occupied in this work with discussions relative to the normal characters of the various organs and tissues. Disquisitions of this sort, though they trench upon another department, are indispensable to a clear and intelligible comprehension of the fundamental principles of pathological anatomy. Without a knowledge of the natural color, weight, volume, and consistence of a structure, how is it possible to obtain distinct conceptions of the numerous and diversified alterations induced in it by disease? The thing is utterly impossible. Without, therefore, a competent share of information of this kind, it is obvious that no physician, whatever may be the extent of his attainments in other respects, can successfully execute the duties of a pathological anatomist. So numerous, indeed, are the sources of fallacy and deception, that even the most enlightened members of the profession frequently commit the most egregious errors, assuming for morbid what is perfectly normal, or, conversely, for healthy what is diseased, or the result solely and exclusively of cadaveric mutations. Misconceptions such as these, abstractly considered, are of no great moment; but when, as is most generally the case, principles are deduced from them, and applied to practice, their mischievous tendency becomes too obvious to require any comment. The same remarks are equally true of hasty and superficial examinations, which can never be productive of any good, but, on the contrary, often lead to a great deal of harm. These are topics upon which the author would not dwell, were he not fully convinced, from daily observation, of their injurious effects upon the practice of medicine and surgery. They lie at the very foundation of the discordant statements which disfigure so many of the treatises of the present day, and which are annually inculcated, with so much zeal and eloquence, in the lecture-rooms of the Western continent.

The embarrassments which the author has had to contend with, in the execution of this branch of his subject, can only be appreciated by those who are acquainted with the meagre and contradictory statements which are to be found in our various treatises on general and descriptive anatomy. Confident, from an attentive perusal, that no satisfactory account could be gleaned from these sources, relative to the dimensions, weight, and physical properties of the different viscera, the author has been induced, in most instances, to substitute the results



of his own observations, for what, in his opinion, appeared to be information of equivocal authenticity. Although his examinations of individual parts have not been so numerous as could be desired, yet he ventures to predict, from the rectitude with which they were conducted, that future researches will not essentially contradict them. It would be well if a standard of comparison could be established, by which to judge of the normal character of every organ in the body; but, to be complete, it is obvious that it must be constructed with reference to the varying circumstance of age, sex, and stature. Until this be accomplished, our statements must necessarily be devoid of that precision which is so desirable in all pathological investigations. Nor can a standard of this sort be determined by a single individual: to be worthy of implicit confidence, and susceptible of general application, it must be the joint labor of numerous inquirers in different parts of the world.

Some apology may be thought necessary for the manner in which the author has expressed himself in relation to the subject of inflammation. Disclaiming to be the follower of any man, or school, in medicine, the sentiments he has avowed are the results of his conscientious conviction, grounded upon personal observation and reflection; and, as such, he does not hesitate to submit them to the scientific scrutiny of his professional brethren. Those who have been in the habit of contemplating disease, as revealed by the phenomena of the living system, and by the knife after dissolution, will, at least, agree with him, that if disease be not, like life itself, a unit, it has few elements, and that these elements are so modified by internal and extrinsic causes, or, in other and more appropriate terms, by texture, age, sex, constitution, climate, season, and other circumstances, as to produce those multifiform features which are a source of so much perplexity to the nosological physician.

In every science some system is required; and in no one is this more necessary than in pathological anatomy. The most natural arrangement that suggests itself is that unquestionably which relates to the affinities existing between the different structures; but, however desirable this might be in some respects, it is evidently not sufficiently specific, and has therefore been rejected. After presenting an account of the general principles of the science, the author considers the lesions of each organ and tissue individually, indicating their anatomical characters, and also, as far as they are known, their diagnostic signs. In thus treating the subject, although some repetition is unavoidable, yet much greater order is attained, as well as wider scope afforded for minute discussion, than by the adoption of any other classification. How far the attempt to blend the description of diseased action with the study of pathognomonic symptoms, which is, in great degree, peculiar to the work, will meet the sanction of the profession, time alone can determine. Without being altogether unobjectionable, it has a direct tendency to augment the utility of pathological science, by pointing out its true connection, and cannot fail, therefore, if properly carried out, to be of the greatest practical benefit to the physician.

Finally, the author is not without the hope that the present treatise, imperfect as it is, will contribute, in some degree, towards the abolition of ancient errors, extend the boundaries of useful knowledge, and diffuse a taste for the cultivation of pathological anatomy.

JULY 1, 1839.



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PART I.



GENERAL PRINCIPLES

OF

PATHOLOGICAL ANATOMY.





# PATHOLOGICAL ANATOMY.

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## CHAPTER I.

### OF INFLAMMATION.

**Preliminary Observations.** — Fluids and Solids. — Different kinds of Sympathy. — Disease, functional and organic. — Inflammation, how modified by Temperament, Age, Sex, Habit, Climate, Season, the nature of the exciting cause, and the character of the tissue; acute and chronic; does not occur with equal frequency in all parts of the body; common and specific. — Nature, Symptoms, and Seat of ordinary Inflammation; Redness, Heat, Pain, and Swelling; Derangement of the Vital Actions; Structure of the Capillaries; joint agency of the Vascular and Nervous Systems; altered Sensibility; preternatural influx of Blood; Experiments and Opinions of Kaltenbrunner. — Congestion; Theories of Boerhaave, Cullen, Vacca, and others. — Terminations and Conditions of Inflammation.

THE human body is composed of solids and fluids, which are intimately blended together, and mutually dependent upon each other for their origin and preservation. Both classes are resolvable into a number of proximate constituents, differing widely in their color, their consistence, and their chemical properties. Of the fluids, the blood is by far the most important, as it is out of it that the solids are formed, and by it that they are nourished and sustained. The quantity of this liquid, on an average, is about eighteen pounds; but it is liable to vary not only in different persons, but likewise in the same individuals at different periods. Not only its amount, but also its quality, is much influenced by the kind of food and drink, the exercise, the climate, and mode of life to which the individual is subjected. It is not my design, in this place, to say any thing of the chemical constituents of the blood, further than to declare that this fluid contains all the elements of the solid parts of the body, that the latter are constantly permeated by it, and that there can be no secretion, whether healthy or morbid, that is not derived from it. The diseases to which it is liable will be made the subject of separate consideration.

The solids consist of what have been called, since the time of Bichat, the tissues; of which the number has been variously stated by different writers, scarcely any two agreeing on the subject. Without occupying the attention of the reader with any discussion of this sort, which would be out of place here, I shall merely remark concerning them that they all differ from each other in their appearance, their composition, their structure, and the purposes which they are designed to fulfil in the economy. With the exception of the muscular and nervous fibres, they all seem to be derived from the cellular element, — a substance which enters so largely into the composition of the animal machine, cementing together its various parts, and forming myriads of meshes for the reception of its nutrient and recrementitious particles.

Combined in various ways, these tissues constitute the different organs, whether parenchymatous, pulpy, glandular, or erectile. The parenchymatous structure is well exemplified in the lungs, which are composed of a soft, spongy, cellular substance, freely pervaded by vessels. Of the pulpy texture, a good illustration is afforded by the brain : here there is very little cellular matter, and the consistence of the organ appears to depend principally upon the presence of a large proportion of albumen. The glandular structure is still imperfectly understood. The liver, which forms the type of this system, is made up of myriads of granules lodged in distinct cells, the walls of which are evidently fibrous ; but, what the precise nature of the contained substance is, whether essentially vascular, or of a character altogether peculiar to itself, is a point which is yet to be determined. The erectile texture, the most perfect example of which occurs in the penis, is composed mainly of arteries and veins, closely interwoven with each other, and susceptible of temporary erection, from the influx of blood.

The tissues, whether they be regarded individually, or as united together to form compound organs, are differently supplied with vessels, with nerves, and with lymphatics ; and, consequently, although they are all important, each in its own way, to the well-being of the general system, some are much more so than others. Whole limbs, containing every variety of texture, may be removed, even in the human subject, without being necessarily followed by the dissolution of the economy ; whereas, scarcely a single one of the internal organs, properly so called, with the exception of the spleen, can be extirpated without the destruction of life.

Connected together by vessels and nerves, as well as, in some instances, by continuity of surface, there subsists between the various parts of the body the closest fellow-feeling. In health, this sympathetic action is carried on so imperceptibly as to escape the attention of the physiologist ; but no sooner is the system deranged than it manifests itself at almost every point of the compass, serving at once to show the nature of the lesion, and the particular tissue, or set of textures, which it implicates. Every one is familiar with the powerful sympathy existing between the uterus and the stomach ; the stomach and the lungs ; the lungs and the heart ; the heart and the brain. Nor is this fellow-feeling less marked in some of the other viscera. In duodenitis, nothing is more common than to see the liver disturbed in its functions ; or, if the disease continue long, even in its structure. The explanation of this is obvious. These two organs, the duodenum and the liver, are not only near neighbors, but the mucous membrane, which lines the former, is extended into the latter, by means of its excretory ducts, into the very centre of each granule. There is thus a direct continuity of structure, in consequence of which disease cannot exist long, or in any considerable degree, in the one without being propagated to the other. So, also, with the urethra and urinary bladder ; the vagina and uterus ; the fauces and tonsils ; the larynx and trachea ; the nose and frontal sinuses ; the Eustachian tube and middle ear. All these cases are examples of what Mr. John Hunter has termed continuous sympathy.

In other cases, again, this sympathy displays itself in parts very remote from the one originally affected. In mumps, that is to say, in inflammation of the parotid gland, a not unfrequent occurrence is a swelling of the testicle, proceeding sometimes to such an extent as to destroy the structure and function of the organ. In what manner, or in accordance with what law of the animal economy, this association is established, it is impossible to say, as there is no similarity of texture any more than a direct nervous connection. The parotid is supplied with filaments from the ascending cervical nerves, and with branches

from the fifth cranial ; the testicle, with filaments from the spermatic plexus, formed by the sympathetic. Thus, then, there is no immediate tie between these organs, and yet, as has been stated, they often display the strongest fellow-feeling. The sympathy existing between the uterus and the breast, and which is so conspicuous both in the healthy and diseased states of these parts, has been endeavored to be explained by the anastomosis of the internal mammary and epigastric arteries ; but it need scarcely be remarked that this mode of accounting for the phenomenon is far-fetched and unsatisfactory, the vessels adverted to having by no means the intimate connection which some have ascribed to them. The same difficulty occurs when we attempt to ascertain the cause of the well-known sympathy between the cerebellum and genital organs. In regard to all of these organs, all that we know is, that there is such a bond of connection, and this, surely, for all practical purposes, is sufficient.

Writers have long since noticed the sympathy between parts of the same structure, situated remotely from each other. In gout, a disease which is seated in the fibrous textures of the extremities, it often happens, especially when the attack is violent, that the pericardium is involved ; the affection being transferred from its original situation to the chest. This is effected by what is called metastasis, a term which only expresses our ignorance. The transfer must take place solely on account of the similarity of structure, not through any direct communication ; for every anatomist knows that there is no connection whatever between the fibrous envelopes of the voluntary muscles and the fibrous covering of the heart. The serous and synovial membranes, the cutaneous and mucous tissues, strongly sympathize with each other, no doubt from the anatomical elements which enter into their composition being so much alike. The liver and the skin are intimately associated by fellow-feeling ; but how this is brought about we have no means of determining.

I have thus briefly adverted to the relationship subsisting between the principal organs of the body, and endeavored to account for it upon anatomical principles. Much time might be occupied in the discussion of the subject ; but I am not certain that it would result in much good. What is most worth knowing, is soonest learned, and least subject to dispute. The relationship which I have described should be carefully studied by the physician, as it will be impossible for him, without an extensive acquaintance with it, to comprehend some of the most extraordinary phenomena observable at the bedside of the sick.

Having made these desultory remarks, we may now proceed a step further, and inquire what constitutes disease ; for every body knows what is meant by health. Disease may be defined to be a departure from the sound state, whether this departure consist simply in a derangement of function or structure. So long as the solid and fluid materials of the body act in concert, there cannot, of course, be any lesion ; health, in all its vigor and perfection, must be the result ; but when the blood and the tissues are arrayed, as it were, against each other, the harmony of the system is interrupted, unnatural action is set up, or, in other words, there is disease. This deranged action, it need scarcely be stated, may be limited, or it may involve a considerable number of organs and tissues at the same time.

Of the essence of disease, very little is known ; indeed, nothing at all ; nor can the utmost ingenuity hope to remove the veil which still envelopes the subject, until the physiology and pathology of the muscular and nervous systems shall be better understood. The proximate cause of morbid action, and the immediate cause of life in the healthy state, are as inscrutable to the human mind as the cause of gravitation, of attraction, and repulsion. All we can boast of is, that



we know something of their effects ; beyond this, it is extremely problematical whether we shall ever be able to penetrate. With this, indeed, every philosophical inquirer after truth should be contented, remembering that the secrets of nature are not easily detected, and that to God alone belongs the knowledge of the intrinsic porperty of things.

It has been already intimated, that diseases are functional or organic. As it is of the latter class that we shall more particularly treat in the following pages, it will be proper that we should speak of them somewhat at length. Before proceeding further, however, it behoves me to explain what I comprehend by the term organic. By pathological anatomists, the word is generally employed to denote some permanent change in the textures of an organ ; but, in the present sense, I would not only include under it all such lesions, but also every temporary alteration which the tissues experience when in a state of disease. The term organic will thus have a wider latitude ; and, as expressing the same thing, we shall often have occasion to use the word structural. If this acception be adopted, it may perhaps be doubted whether, under any circumstances, there can, strictly speaking, be a functional disease, or, in other terms, a mere aberration of the physiological state of a part, without some change in its anatomical elements. The question, at all events, is not settled.

Bearing in mind the above definition, it may be assumed, as a general proposition, liable to few exceptions, that all organic diseases, whatever be their seat or extent, are the result of inflammatory action, either of an acute or a chronic kind. To many, this proposition may be startling ; nevertheless, if it be carefully examined, it will be found, I doubt not, to be grounded on fact. The truth of this remark will appear more evident as we proceed.

The second proposition that may be stated is, that every inflammation, irritation, or morbid action, is originally of a local nature ; that is to say, it always makes its impression in the first instance upon some particular part, texture, or organ. After this inflammation has continued for a longer or shorter period, it often happens that it extends to and implicates other structures. If, for instance, the mucous membrane of the stomach be fretted, the morbid action accruing from this cause will be confined at first to that lining ; or, in more comprehensive terms, the disease will be strictly local in its character : by degrees, however, as the disorder progresses, the adjacent parts, such as the submucous cellular tissue, become affected ; and, spreading still further, it next invades the muscular fibres of the organ, and, finally, the peritoneal covering. It is in this manner that most affections, which are originally local, extend their sphere of action so as to become general, whether they be considered simply in reference to one organ, to several, or to a great number of them.

Inflammation of particular organs and textures is usually designated by adding the Greek term *itis* to the anatomical name of the part affected, as gastritis, laryngitis, pleuritis. In some instances the old nomenclature is retained. Thus, inflammation of the tonsils is called quinsy ; of the eye, ophthalmia ; of the urethra, gonorrhœa ; of the parotid gland, mumps.

In regard to its progress, intensity, and mode of termination, inflammation is greatly modified by temperament, age, sex, habit, climate, and season, by the nature of the exciting cause, and, above all, by the character of the tissue in which it is developed. The time of life which seems to be most obnoxious to this disease, is from the first to the tenth year, nearly one half of the entire mortality occurring during this interval. Affections of the cutaneous, mucous, and lymphatic systems, are particularly rife during this period, and carry off an immense number of children. Scarcely less common is inflammation of the



arachnoid membrane. Pleuritis, pneumonitis, cerebritis, and hepatitis, with carditis, phlebitis, and arteritis, are comparatively infrequent before the age of manhood; from thence on, however, they are by no means unusual, and prove a fruitful source of destruction. Diseases of the genital organs are rarely observed before the age of puberty; indeed anterior to this period, these structures seem to lie in a dormant state. Once roused into action, however, they deeply sympathize with the other viscera, and hence the frequency of organic maladies of the uterus, the ovaries, breasts, and testicles, towards the decline of life. Affections of the urinary bladder are comparatively rare in the young, whilst they are very common in the old.

Considered in reference to sex, some organs and tissues are more liable to be affected with inflammation than others. Cerebritis and splenitis, as well as carditis and arteritis, are infinitely more common in men than in women, probably, from the organs of the former being more exposed to perturbing agents, both of a physical and a mental kind. On the other hand, it is a well-established fact, that the female sex is much more obnoxious to inflammation of the peritonæum, of the veins, and lymphatics, than the male.

The seasons of the year in which inflammation is most prevalent are winter and spring; it is also more common in moist than in dry situations, and in cold and hot climates than in such as are temperate. In northern latitudes, the parts most frequently involved are the lungs, the air-passages, and the fibrous textures; in tropical ones, the mucous membrane of the large bowel, the liver, and the skin.

The above are circumstances in the history of inflammation which, of course, we can only glance at; the subject is one of vast interest to the practising physician, and the attentive study of it cannot fail to be of the greatest benefit to him.

The rapidity with which this disease may run its course is subject to a considerable number of circumstances, amongst which the most important are the nature of the exciting cause and the structure of the part affected. As a general rule, it may be stated, that the more liberally an organ is supplied with vessels and nerves, the more easily will it be disorganized. Thus, an inflammation of the mucous membrane of the bowels will usually terminate much more rapidly either in health, or in death, than the same disease seated in a fibrous membrane, a tendon, ligament, or bone.

When an acute inflammation, after having existed for some time, does not terminate in the usual manner, it is said to become *chronic*. Paradoxical as it may at first sight appear, there are some varieties of this disease that assume a chronic form at the very moment of their outset. The irritation which accompanies the tubercular deposition, and some species of pure uncomplicated pneumonitis, are of this description.

Considered in regard to its degree of intensity, inflammation presents a great variety of forms, from the slightest possible derangement to the most intense morbid action. In this respect, therefore, the disease may be said to be mild, moderate, or violent. For the purpose of designating the first of these conditions, some writers are in the habit of employing the term *sub-acute*; a word which seems to me to be ill-chosen, and consequently conducive to error. The terms mild, slight, or moderate, are free from this objection, and will, therefore, be retained in the following pages.

Inflammation is sometimes *latent*, or, in other words, there is an entire absence of the symptoms by which it is ordinarily characterized. Examples of this variety of morbid action are found in certain forms of pneumonia, arachnitis, and typhoid fever. In the latter affection the glands of Peyer are often very

much diseased, and even extensively ulcerated, without any of the usual manifestations of inflammation. Again, inflammation may be *intermittent*, as in certain forms of neuralgia, in chilblain, and, perhaps, in ague.

The disease before us does not occur with equal frequency in all the organs and tissues of the body. There are some parts, in fact, in which it has been doubted, though, as I think, without any foundation in truth, whether this affection ever takes place. Such are the nails, the epidermis, and the hairs. These structures are supposed, by general anatomists, to be destitute of vessels, and, therefore, incapable of performing any vital action. This, however, is merely a conjecture; the fact remains to be proved, and, for my own part, I feel as certain that these textures are susceptible of inflammation, as that the liver is, the stomach, or any other organ.

The cellular, mucous, serous, and dermoid textures are particularly prone to inflammation. It is here that the disease can be studied with the greatest advantage, both as it respects its phenomena and modes of termination, inasmuch as it is usually well marked, intense in degree, and rapid in its progress. The synovial membranes, the fibrous envelopes, the bones, ligaments, and cartilages, with the muscles and their tendons, inflame with difficulty; but when the disease has once fastened itself upon them, they readily yield to its influence, the sufferings are often excessively severe, and the consequences very serious. The bloodvessels, nerves, and absorbents are all more or less liable to phlegmasia. The conservative powers of these structures, especially of the former, is remarkable, and is strikingly evinced in cases of gangrene, where, as will be hereafter shown, they frequently retain their vitality amidst the half putrefied mass.

Of the organs, some are more ready to take on inflammation than others. Those which are most frequently affected, at least in this country, are the lungs, spleen, liver, uterus, and brain. The heart, ovaries, thyroid body, pancreas, prostate gland, testicles, and kidneys are comparatively rarely the seat of this disease.

Respecting *specific* inflammation, some parts, again, are more prone to this disease than others. Thus, erysipelas commonly attacks the skin; anthrax, the subcutaneous cellular tissue; rheumatism, the fibrous envelopes of the extremities; tubercle, the lungs; scirrhus, the glandular organs. In the skin, numerous varieties of inflammation, both of an acute and chronic kind, are observed, that never occur in any other of the elementary textures and systems of the body. To this category specially belong the different species of eruptive and scaly diseases, which have their seat, for the most part, in the superficial portion of the dermis, the network of Malpighi, and the cuticle.

Although we have here employed the term "*specific*," yet it must be confessed that it is one of very equivocal signification; and, in order, therefore, to remove all ambiguity respecting it, it will be necessary to determine, if possible, the sense in which it is understood by professional men. Almost all surgical authors agree in stating that there are two descriptions of specific inflammation; one of which is produced, it is alleged, by a peculiar condition of the constitution, the other by the action of a special virus. Under the influence of the first are developed what are denominated the heterologous formations, such as tubercle and scirrhus, together with gout, rheumatism, and erysipelas; under that of the latter a disease which manifests a particular train of phenomena, which exerts its effects only upon a particular set of structures, and which can only be excited by particular causes. To such a classification, surgically considered, there can be no special objection; but, viewed philosophically, or in reference to the laws of healthy and abnormal action, there is

no ground whatever for such a distinction. All morbid action, indeed, whether acute or chronic, is, properly speaking, specific, or what is the same thing, exerts a particular influence in relation to the particular structure which it implicates, being accompanied by particular symptoms and particular products.

Let us now proceed to investigate the nature of inflammation, its seat, and the phenomena which characterize it. In the whole range of medical science there is no topic which has attracted so much attention, and been the source of so much discussion, as the one now under consideration. Theory after theory has been framed, each in its turn to live for a while, and then to give way to some other, either more ingenious, or fostered and protected with more talent and pertinacity by its author. To review the various notions that exist on this subject would be a task as irksome to the inquirer as it would be unprofitable to the student of pathological anatomy. At every step the mind would be bewildered with idle conjecture, and at the close of the investigation it would be no better off, so far as real and substantial information is concerned, than at the outset. We can only express our regret that so much time has been misspent, so much talent wasted, in the construction of hypotheses, which, although sometimes plausible, do not, in the majority of instances, embrace a single well-ascertained fact to repay us for the trouble of examining them. Pathological anatomy is emphatically a science of observation and induction: in pursuing our inquiry, we shall, therefore, limit our remarks to a simple analysis of what is known respecting it; referring such of my readers as are fond of speculative reasoning to the various works that have been published on the subject within the last two centuries. He will there find a melancholy illustration of the fact that genius, however often it has wandered in quest of truth, has rarely succeeded in detecting it.

The *phenomena* usually enumerated as marking inflammation are redness, heat, pain, and swelling. These signs, however, are not constantly present, and, as might be supposed, they are liable to vary according to the nature of the exciting cause and the character of the part affected. But these are not the only circumstances which occur in inflammation: in every case there is a perversion of the vital actions, attended with an altered state of the nutritive and secretory functions. To affix to these several conditions their respective value, it will be necessary to allot to each of them a considerable share of attention. Most writers, until recently, attached too much importance to some of them, and too little to others; whilst they entirely overlooked the fact that they are always greatly modified by the nature of the tissue in which the malady, of which they are the indices, is located. If we regard the four phenomena, redness, heat, pain, and swelling, referred to above, as being essential to the process, it will be at once perceived that there can be few inflammations; and we shall, therefore, be obliged, in describing diseases, to invoke other names, such as irritation and fever; a blind adherence to which has unfortunately tended too much to retard the progress of pathological science. Boerhaave enumerated one hundred and fifty varieties of fever: had he enumerated a thousand more he would have been much nearer to the truth, for he might then have specified nearly every form of inflammation, whether occurring in the external parts of the body, or in the interior organs. The word "fever" is a conventional one, and is employed to designate, not the nature or seat of a disease, but simply the phenomena which it manifests. So also with the term irritation. Mr. Travers and others have written extensive treatises on this subject; but have they pointed out anything concerning the essential character of this disease? have they



told us anything of the peculiar condition of the nervous and vascular systems which accompanies it? So far as I am acquainted with their labours they have not; and yet men continue to talk about irritation, with its numerous varieties, as if they had the most perfect knowledge of its nature, seat, causes, and symptoms. A course such as this cannot but have a most dangerous tendency in practice; for what one physician describes as a fever, another will consider simply as an irritation, a third as an inflammation, and in this way no principles can ever be introduced as standards of treatment. The practice of medicine must continue to ebb and to flow with every tide of professional opinion.

The time, however, cannot be far off, when the term fever must be entirely discarded from our books, and diseases named according to the tissues they implicate. Then, and not till then, can it be expected that the laws of deranged action will be properly interpreted, or fully comprehended. All diseases, I feel confident, will ultimately be found to have "a local origin and habitation"; and if this opinion shall ever be proved to be true, the whole class of febrile maladies, with its hundred varieties and subdivisions, will cease to have a place in our medical treatises. The artificial nosology of Sauvages, of Hoffmann, Cullen, Hosack, and a host of minor worthies, has had its day; its authority is at an end; its sceptre is departed; philosophy has usurped its place, and derides its aid. For the great changes which have been effected, and which are still going forward, in relation to the doctrine of morbid action, we are mainly indebted to a profound cultivation of pathological anatomy, which, since the time of Bichat, a period of forty-five years, has advanced with such rapid strides, and reduced the healing art to a degree of certainty, which could scarcely have been anticipated.

The *redness* of an inflamed part presents various shades, from the slightest rose to the deepest purple. There are some tissues which naturally contain little blood, or which convey only serosity, and these, of course, are never much discolored when affected with disease. The tendons, ligaments, and cartilages are seldom reddened, no matter what may be the intensity of the inflammation. In the fibrous membranes, such as the pericardium, the dura mater, and sclerotic coat of the eye, the discoloration is usually of a lilac or purple hue, with a shade of blue. In the mucous lining of the alimentary tube, the redness, in the early stage of the disease, is bright and florid, like that of arterial blood; but, as it progresses, it often assumes a dark violet, or black appearance, especially when it is about to pass into gangrene. A striking exemplification of the truth of this remark is afforded by the mucous membrane of the fauces in the malignant form of scarlatina. In the beginning of this disease, the tonsils and adjacent parts are of a bright red, which is often, in the course of a few hours, converted into a deep purple. In the skin, the redness is sometimes of a scarlet color; at other times, it has a yellow tinge, with various shades of mahogany. The yellow color is most commonly witnessed along with derangement of the liver; hence the frequency of its occurrence in the latter stages of erysipelas and anthrax. In inflammation of the pleura and peritonæum, the redness is, at first, of a lilac hue; afterwards of a scarlet, brownish, or violet. In the arachnoid there is rarely, if ever, any perceptible discoloration.

Inflammation of the spleen and liver is attended with a purple hue: when the brain is affected, the color is generally rosaceous, cineritious, or like the lees of wine. The salivary glands are usually of a pink complexion; the kidneys, of a deep violet; the testicles and ovaries, of a reddish yellow. In the lungs the color varies from the slightest rose to the deepest purple.



The redness is generally greatest at the centre of the inflamed part, from which it gradually diminishes in intensity until it reaches the natural standard of the tissue or organ in which it is located. It may be superficial or deep-seated; circumscribed or diffuse; arborescent or capilliform; punctuated or blotch-like. In some instances, as in the lining membrane of the arteries, the color is uniform, having the appearance as if it were dyed into the part. Whatever form it may assume, the immediate cause of it is an unnatural influx of blood into the capillaries, the red globules being admitted in much greater numbers than in the sound state. So long as the circulation in these vessels is carried on vigorously, the redness in many of the tissues will be of a bright scarlet tint; but no sooner does the blood begin to stagnate than the part assumes a darker hue, from some chemical change, probably, which the fluid experiences under such circumstances.

When a part is inflamed, is there really a preternatural development of heat? Mr. John Hunter thought there was not; and, in corroboration of this opinion, he adduces some experiments which he performed on the inferior animals. He made a wound in the right side of the chest of a dog, and, pushing the thermometer in contact with the diaphragm, ascertained that the temperature of the part was  $101^{\circ}$ . A large dossil of lint was then put into the opening, and its surface covered over with adhesive strips. On the following day, when the parts were in a state of inflammation, the foreign substance was removed, and the instrument being again introduced, the heat was found to be exactly the same as before, namely,  $101^{\circ}$ . Similar experiments were made on the rectum and vagina of an ass, with the same results. There would thus seem to be no real increase of temperature. As a general rule, this is no doubt the case. Nevertheless, it has been clearly ascertained that, under certain circumstances, the reverse obtains.

The difference is certainly not so great in the external as in the internal parts of the body. Yet even here there is reason to believe that the temperature of the inflamed structure is frequently higher, by several degrees, than that of the blood. In the natural state, the average heat of this fluid, as I have ascertained by numerous experiments, is  $96^{\circ}$ , whereas, in disease, the thermometer sometimes falls as low as  $92^{\circ}$ , or rises as high as  $104^{\circ}$ .\*

Every one knows how extremely hot the breath is in inflammatory affections of the throat, which can only be explained on the assumption that there is a partial increase of temperature. That the heat of the body, like every other physical endowment, is liable to be modified, is a fact which has been clearly established by the researches of physiologists. Sir Everard Home states that the oviduct of a frog ready to spawn, is two degrees hotter than the heart; and it has been ascertained by Professor Duglison,† that, during labor, the temperature of the uterus sometimes rises to  $106^{\circ}$ . A similar phenomenon has been observed to occur in plants. M. Huber‡ found that, when the heat of the atmosphere stood at  $21^{\circ}$  of the centigrade thermometer, the instrument surrounded with spadices of the arum cordifolium, during the process of fecundation, rose as high as  $42^{\circ}$ .

From the foregoing facts, it clearly appears that there is occasionally a considerable extrication of heat, even when there is no inflammation, or when there is merely a slight approximation towards it. The subject of animal heat is still enveloped in doubt: that it is dependent, in great measure,

\* See "The Western Medical Gazette," vol. i.

† American Med. Intelligencer, Feb. 1839.

‡ Ellis on Respiration, p. 204; also, Mayo's Physiology, p. 79, 4th ed.

upon the nervous system, appears, however, sufficiently obvious; and if this point be conceded, no difficulty will be in the way of accounting for the alterations of temperature which occur in different conditions of the body. A deranged state of the nervous function would be accompanied, of course, with a corresponding modification of the heat of the part, whether this was higher or lower than the natural standard; and this, indeed, is precisely what happens when inflammation is seated in parts remote from the central organ of the circulation. In cases of erysipelas, furuncle, and anthrax, the thermometer has been observed, in numerous experiments made since the time of Mr. Hunter, to rise as high even as  $107^{\circ}$ . Similar results have been noticed in tetanus and acute rheumatism. Becquerel and Breschet found the temperature of a scrofulous tumor raised as much as  $5\frac{1}{4}^{\circ}$  above the general heat of the body. There can, therefore, be no doubt whatever, as was before intimated, that, in certain cases of inflammation, whether occurring in the interior organs or in the external parts, there is a real augmentation of temperature, over and above what is observed at the heart, the great fountain of the circulation. In some parts of the body, such as the ligaments, bones, cartilages, fibrous membranes, and tendons, the extrication of heat must necessarily be very slight.

*Pain* is one of the most important symptoms of inflammation. Like redness, it varies in degree according to the nature of the affected part. As a general rule, it may be stated, that it is most keenly felt in those structures which are most liberally endowed with vessels and nerves. There are some tissues which, in the healthy state, are perfectly void of sensation, but which are exquisitely sensitive when laboring under disease. Thus, for example, a sound bone may be sawed, rasped, and even burnt, without the animal evincing the least uneasiness; but no sooner does it become inflamed than it gives rise to the most excruciating torture, leading often rapidly to hectic, with its whole train of evils. Similar phenomena occur in the fibrous membranes, the tendons, ligaments, and cartilages. In regard to the different viscera, it is a singular fact, that they generally experience much more pain when their coverings are affected than when their proper structure is involved. In hepatitis, the inflammation often proceeds to a most destructive extent before the individual is aware of his danger. Cerebritis is seldom so painful a malady as arachnitis; and a pleuritis, it is well known, is invariably attended with more suffering than a pneumonitis.

The degree of suffering evinced by the mucous membranes, in a state of inflammation, is subject to much variety. In some situations the pain is excessive, whilst in others it is literally absent, the disease proceeding in its work of disorganization without giving the individual, so to speak, the slightest intimation of it. In pulmonary phthisis, nothing is more common than to find ulcers in the ileum and colon, sometimes of great size, where there was no sign whatever of their presence during life. It is a singular fact, in relation to this subject, that the pain is usually much greater when the inflammation is seated at the extremities of the mucous membranes, or at their junction with the skin, than when it involves the intermediate points. Bichat has endeavored to explain this difference, with perfect success, as I conceive, by referring it to a difference of organization. The mucous lining of the intestinal tube, and of the air-passages, which often manifests very little sensibility when inflamed, receives its nerves almost entirely from the ganglionic system; whereas the reverse is the case with the conjunctiva, the fauces, the urethra, and urinary bladder, the vagina and rectum, these parts being liberally supplied by filaments derived from the cerebro-spinal axis.\*

\* See Bichat's General Anatomy; also, Horner's Pathological Anatomy, p. 81.

Not only does the pain vary in degree, but also in its character. In the cellular tissue it is acute and pulsatile; in the pleura, sharp and lancinating; in the lungs and glandular viscera, obtuse and heavy; in the skin, prurient and smarting; in the bones, dull and gnawing. Sometimes the pain is persistent, sometimes intermittent, sometimes periodical; but, what is more remarkable than all is, that it is not unfrequently felt at parts very remote from the one originally and mainly affected. We have a familiar instance of this peculiarity in the hip disease of children, in which the earliest symptom complained of is pain in the knee. In hepatitis, the right shoulder is often the seat of the suffering; in cystitis, the head of the penis. We are sometimes enabled to account for this by the direct nervous communication, but more frequently the matter is entirely inexplicable. When inflammation is about to pass into suppuration, the pain usually becomes throbbing, and the patient is seized with shivering, with fever, and, in some instances, with delirium. After this process is fairly established, it almost always diminishes in intensity, or even wholly subsides. Pressure generally increases the pain, and in some cases the slightest touch of the finger produces intolerable suffering.

The proximate cause of this symptom has been variously accounted for. It is usually supposed to be owing to the unnatural influx of blood, the increased size of the capillaries, and to the quantity of effused fluids, which compress, it is said, the delicate nervous filaments of the part concerned. This seems to me, however, to be taking only a partial view of the case. To complete the theory, it is necessary to assume that the nervous filaments themselves are affected, altered, or deranged, independently of the causes just adverted to; and in this idea there is nothing in the least repugnant to the laws of pathology. What the precise nature of the change is we cannot define; nor is this a matter of much importance.

The effect of augmented circulation in producing augmented sensibility, is strikingly evinced in what occurs in inflammation of the hand. If the part be allowed to hang down, severe throbbing pain is instantly felt, which is as instantly relieved, in many cases, by putting the limb in an elevated position. Cold applications, by constringing the vessels, lead to the same result, and hence their beneficial effect in the treatment of external inflammation.

The fourth and last symptom of inflammation, which has been particularly specified by writers, is *swelling*. This is occasioned partly by the enlargement of the vessels, but chiefly by the effusion of serosity, lymph, blood, or pus, into the cellular tissue. In its degree it varies according to the laxity and vascularity of the part concerned. It is always well marked in the subcutaneous cellular substance, whilst the skin itself is generally little, if at all, affected by it. Inflammation of the serous and fibrous textures, the ligaments, tendons, muscles, cartilages, and bones, is usually unattended with swelling. The same remark is applicable to the internal viscera. The mucous membranes are rarely the seat of tumefaction. Hitherto, this symptom has been chiefly noticed in the vulva, at the mouth of the larynx, and in the conjunctiva of the eye.

Although the swelling generally comes on gradually, yet, in some instances, it proceeds with astonishing rapidity, at the same time that it spreads over a large extent of surface. The sting of the bee, wasp, hornet, and yellow-jacket, and the bite of the rattlesnake are often attended with the most frightful tumefaction, which makes its appearance sometimes in a few minutes, and speedily diffuses itself over an entire limb, or even the whole body.

From the hasty survey which has been taken of these symptoms, we are authorized to conclude that they are by no means entitled to the stress which



has been generally placed upon them by writers. In many instances there is an entire absence of at least one or two of them, and yet the part is absolutely in a state of high inflammation. How often does it happen that enteritis is lighted up, and goes on to destructive disorganization, without even the slightest indication of its presence? In arachnitis, the only symptom, frequently, is severe cephalalgia, with delirium and partial paralysis. The patient dies, and, on examination, the membrane is found to retain its natural thinness, and to be as free from injection as in the sound state. In such a case, should there be but little effusion of serum and fibrin, a superficial observer might conclude that there never had been any inflammation, or that what he saw was the result solely of irritation. The injurious tendency which such a mode of procedure would exert on the practice of medicine is too obvious to require any comment in this place. In reasoning on this subject, the physician should constantly bear in mind the important fact, that the symptoms which have been enumerated above, although they are frequently all present, are not necessarily so, and that the absence of some of them is not a sufficient proof that there does not exist inflammation. By such course alone can he expect to escape error.

Besides these phenomena, there is always, in well-established inflammation, a perverted state of the vital action. In none of the tissues is this state, perhaps, ever entirely absent; yet, as might be expected, it is much more conspicuous in some than in others. It is sometimes, indeed, the only symptom present, or the only one which can be recognized. In gastritis, the only manifestation of which is frequently irritability, without heat or pain, or uneasiness on pressure, the digestive function is entirely suspended, gastric juice is no longer secreted, and the organ is oppressed by the mildest articles of food. In the duodenum the process of chylification is interrupted, retarded, or perverted; in the liver, bile is either no longer deposited, or it is furnished in small quantity, and vitiated in quality. In high degrees of inflammation of both kidneys, there is sometimes a total want of urine, and the individual dies under all the symptoms which characterize the retention of that fluid in the bladder. It should be observed here, that as a general rule, this derangement of the functional action is always greatest when the irritation is at its height, and that, from this period on, it gradually diminishes until the disease subsides. When the office of an organ is to receive some external impression, it does either not so at all, or only very imperfectly. The inflamed eye is no longer able to take cognizance of light; the Schneiderian membrane does not notice odors; and the ear is incapable of distinguishing sounds. When the brain is affected, the intellectual faculties are deranged, and the individual raves with delirium, or lies, like an automatic mass, dead to all surrounding impressions.

The function of absorption is often very much impaired in this disease. A solution of strychnine applied to an inflamed serous membrane, as the pleura, will not result in any injury to the animal, or only in a very long time after the contact has been effected. In some experiments made by Dr. Gendrin of Paris, and which I shall hereafter notice more particularly, prussic acid was applied with impunity to the conjunctiva of the eye, the Schneiderian membrane of the nose, and the mucous lining of the vagina, which had been previously inflamed by hot oil and tincture of cantharides. Notwithstanding the results of these experiments, correctly stated, no doubt, by the French philosopher, experience daily teaches us that whilst some substances are rejected by the organs and tissues, when in a high state of inflammation, there are others, the absorption of which is still, to a certain extent, carried on. In the stomach, for example, mild diluent drinks, such as gum-water, flaxseed tea, or



arrow-root, are rapidly conveyed into the circulation, and are usually more or less employed by practitioners. If the quantity given, however, be so great as to oppress the affected organ, absorption will cease, and the fluid will be ejected. In the serous cavities nearly the same circumstance is observed. When the fluid that is effused in these situations exceeds several quarts, the absorbents appear to be incapable of taking it up, and the surgeon is obliged to evacuate it. Acetate of morphia applied to a piece of skin that has been inflamed by a blister, will tranquillize the system nearly in as short a period as when it is introduced in the ordinary way.

Not less remarkably altered is the nutritive function. If an organ remain for a considerable time inflamed, the particles which are requisite for its growth and nourishment are withheld, and, in consequence, it gradually sinks into a state of atrophy. In more rapid cases, the part retains its natural bulk, but undergoes a change of color and consistence, from the imperfect admission of blood, and from some derangement of the molecular structure. This state is remarkably conspicuous in several of our organs and tissues, and will be described hereafter under the name of softening, mollescence, or ramollissement.

The next subject which we have proposed to discuss is the *seat* of inflammation. That this is in the capillary vessels is a fact concerning which there exists no dispute. Of the nature of these vessels themselves, however, different views have been expressed by anatomists, and it will, therefore, be necessary, before proceeding farther, to examine briefly their situation, structure, and functions; for in this way alone can we expect to throw any real light upon the nature of the present disease.

The capillaries are those minute tubes which are every where interposed between the arteries and the veins. It was at one time imagined that they formed a distinct set of vessels by themselves, perfectly independent of the rest of the vascular system, an opinion which has been abundantly disproved by the researches of modern anatomists. It is now well known that they not only communicate directly with the arteries and the veins, but likewise that they are, as it were, merely so many prolongations of them. What their precise structure is we have no means of determining; nor is it known where the arterial capillaries terminate, or the venous begin. The transition is too gradual, perhaps, to enable us ever to arrive at any positive conclusion in relation to the subject.

The walls of the capillaries, as may be imagined, must be extremely thin, delicate, and transparent, otherwise it would be much easier to discern them. Bichat states that they are formed entirely out of the inner arterial and venous membrane, the other tunics being excluded, as he alleges, from their composition. An opinion precisely similar to this is advanced by Beclard. He asserts that the parietes of the capillaries are scarcely to be distinguished from the substance of the organs in which they are situated, and thence draws the inference that they are rather formed out of this substance than that they possess walls of their own, acknowledging, however, at the same time, that it is not impossible that the internal tunic of these vessels is uninterruptedly continued from the arteries to the veins. Admitting, as we have already done, the utter impossibility of determining the precise point at which the arterial tubes in question terminate, and that at which the venous tubes commence, it would seem that the doctrine of the two French anatomists is entirely too exclusive in its bearings to entitle it to confidence. It is true, neither dissection nor microscopic observation can afford us much aid in solving the difficulty; for the vessels are altogether too minute to enable us to investigate their structure with any degree of accuracy; still, where these means fail us, we are warranted in going to analogy, and in availing ourselves of its assistance.

Assuming analogy, then, as our guide, let us extend our examination to other tubular structures, and see if we cannot find a more philosophical method of disposing of the question than that resorted to by the French anatomists. Let us, for example, take the excretory duct of the liver, and follow it along its ultimate ramifications in the organ, the secretions of which it is intended to carry off from the system. In the early part of its course it consists, plainly enough, of two tunics, which, as they extend into the substance of the viscus, become so excessively attenuated that it is impossible not only to separate them from each other, but even to distinguish them from the surrounding textures. Now that the inner membrane is prolonged as far as the very point at which the tube terminates, or rather where it takes its origin, no one can for a moment doubt, for the bile is a highly acrid fluid; and hence nature, in order to guard against suffering, has wisely furnished the canal with a mucous lining. But is it reasonable to presume that, because we can no longer discern the external tunic, it must necessarily be wanting? Is it not more philosophical to suppose that both membranes exist, than to say that one is preserved and the other lost? This conclusion involves nothing that is either absurd or improbable; and, although not founded on actual observation, it is much more in conformity with sound anatomy and physiology than any other that has been framed in relation to the subject. If, now, we apply this mode of reasoning to the capillaries, it will at once be perceived that the theory of Bichat and Beclard is untenable; and that these vessels, instead of possessing, as they imagined, only one tunic, have precisely the same number as the arteries and veins, between which they are situated. If this idea be adopted, it follows, as a necessary corollary, that the capillaries are nourished and animated, like the rest of the vascular system, by vessels still more minute, and by nerves so excessively delicate as to elude even the most powerful microscope.

Viewed in reference to their caliber, the capillaries are divisible into two classes. The one embraces those minute tubules which, though invisible to the naked eye, are found, when examined with the microscope, to be capable of carrying a continuous stream of blood, so as to give the part in which they are located a red appearance; the other includes those delicate vessels, the cavity of which is so small as to admit only a single globule at a time, and which it is extremely difficult to detect even with a good magnifier. By reflecting for a moment on the size of the red particles of the blood, estimated by most writers to be about the three thousandth part of an inch, the reader will be struck with the great tenuity of these vessels.

That the capillaries do not abound equally in all the organs and tissues, was rendered sufficiently obvious in speaking of the phenomena of inflammation. The parts which form the basis of the skeleton, together with the tendons, the cellular substance, the epidermis, nails, and hairs, have, comparatively, few of these vessels after the body has attained a certain degree of development. In the early stages of life, however, most of these structures are highly vascular, and can be readily injected. The serous membranes appear to possess very few capillaries; in the healthy state, in fact, none can be discerned in them; yet, when inflamed, they are rendered highly vascular, and thousands of minute vessels, which before were invisible, are now perfectly distinct, giving the affected part a beautiful reddish aspect. The capillaries abound in the mucous membranes, the skin, the liver, spleen, lungs, and kidneys. They are also very numerous in the heart, the muscles of voluntary life, in the brain, and in the pia mater.

Thus situated, and thus constituted, the capillaries form by far the most

interesting as well as the most voluminous portion of the vascular system. To it are confided the important functions of nutrition, secretion, calorification, and, perhaps, also, at least in part, that of absorption. Whilst the larger vessels perform the office merely of sangui-duets, it is in the capillaries that the fluid and solid materials are brought into those intimate relations which precede the conversion of the one into the other, and which are necessary to their vitality and support. In inflammation the capillaries play a most important part; blood is sent into them in unnatural quantity; their action is perverted, and, in consequence, various fluids are poured out which are foreign to the normal condition of the economy. These, however, are not the only structures that are affected. It is highly probable that the nervous filaments are equally engaged in the morbid enterprise, though this is a point concerning which our information is extremely slender. The fact is certain that neither of these tissues can be long involved without the other participating in the derangement.

The joint agency of the nervous and vascular systems, in the production of inflammation, has been happily illustrated by the researches of Magendie, Brodie, and Philip. The first of these distinguished physiologists ascertained that, when the ophthalmic branch of the fifth pair of nerves is divided in the cranial cavity of a rabbit at the Varolian bridge, inflammation is speedily lighted up in the surface of the eye, which eventuates in opacity of the upper segment of the cornea. What is still more remarkable is, that, when the nerve is cut on the petrous portion of the temporal bone, so as to involve the destruction of the ganglion of Gasser, the resulting irritation is not only more violent in degree, but much more deeply seated, as well as more deplorable in its effects, the consequence being nothing less than a complete disorganization of the organ.

Analogous effects follow the division of the pneumo-gastric nerves. When these cords are cut high up in the neck, the lining membrane of the air-passage assumes a dark color, the lungs are engorged with black blood, and an abundance of serosity is poured out into the parenchymatous texture, as well as into the pulmonary vesicles and the minute branches of the bronchiæ. The pleura generally participates in the irritation, and there is almost always more or less inflammation of the stomach, with a suspension of the secretion of the gastric juice.

The investigations of Mr. Brodie have successfully elucidated the phenomena which ensue upon tying the brachial plexus of nerves. Animals that have been subjected to this experiment are seized, in a short time, with inflammation of the integuments of the remote parts of the limb, which gradually progresses until all the soft structures are invaded by gangrene. The results of this experiment enable us to account for certain circumstances that have been long noticed by practitioners in particular morbid states of the system. It is a remarkable fact that a part affected with palsy is much less capable of withstanding the ordinary impressions of physical agents, than one receiving its customary supply of nervous influence. A burn in a paralytic person creates much more serious mischief than in one that enjoys perfect health; and the same is true in regard to blisters and other irritants, the injudicious application of which often leads to the destruction of large portions of the skin and subjacent cellular tissue. There is little doubt that the inflammation of the bladder, which always supervenes upon serious injury of the spinal marrow, is caused in the same way; that is, by the interruption of the natural supply of the nervous influence.

In whatever manner parts are deprived of their nervous influence, it is pre-



sumable that they are brought under relations somewhat analogous to those of a frozen limb. The temperature is lowered, the sensibility impaired, the process of nutrition perverted, — in a word, the natural connection between the vessels and nerves is broken up, and hence that series of phenomena known under the name of inflammation. Let us pursue this subject a little further.

The very first step in the process of inflammation is an altered sensibility of the part, produced by some hurtful agent, which the system makes an effort to dislodge. To effect this, the local impression is reflected upon the cerebro-spinal axis, and through this again upon the heart, which, being sympathetically incited to increased action, more blood flows to the part concerned than it is accustomed to receive, at the same time that the capillaries are perceptibly dilated. Those who maintain that the capillaries possess an inherent contractility, by virtue of which they aid in the circulation, will probably feel disposed to deny the agency of the heart in bringing about this preternatural determination of blood; to such I will only say, that if they will carefully study the subject, they will arrive at a different conclusion. That these vessels do contract and dilate, no one will dispute; for the experiments of Hunter, Wilson Philip, Thomson, Hastings, and other writers, have fully decided this point; all that I contend for is, that the capillaries have no vermicular movement, and that they are, therefore, incapable of carrying on the circulation without the direct influence of the heart. In the inceptive stage of inflammation, this sympathetic action of the heart is no doubt so slight as frequently to escape the attention of the observer; as the disease progresses, it assumes a more distinct character, and can always be easily recognized.

The phenomena above alluded to, namely, the preternatural influx of blood, and the dilatation of the capillaries, can be easily detected by exciting irritation in the mesentery of a rabbit, the tale of a tadpole, the fin of a fish, or the web of a frog's foot, parts which are perfectly transparent, and therefore well calculated for the purpose. On viewing these structures with a microscope, in the sound state, numerous channels will be observed filled with blood, the red globules of which roll along in the most regular and beautiful order. If they be now irritated with spirits of wine, hot water, or diluted acid, the little rivulets just referred to, will be found to become dilated, from the manner in which the blood is crowded into them by the heart, which, in order to remove the local difficulty, is excited into sympathetic action. In a few minutes hundreds of vessels, which were previously invisible, will be seen shooting out in different directions, and connecting themselves with the sides of those that appeared in the first instance. These are not new channels, but old ones appertaining to the second class of capillaries, which are rendered evident by the intromission of red particles, which are either excluded in the healthy state, or pass along in so slow and gradual a manner as to elude the eye of the beholder. The little bodies which are thus introduced do not circulate, at first, with the same facility as in the other parts of the body; for, as the dilatation of the little rivulets takes place by degrees, they have to force their way, and hence, after having advanced a short distance, they retreat slightly immediately after each pulsation of the heart, rebounding, as it were, upon each other. In this manner they travel on, surmounting every obstacle, until they finally reach the corresponding capillary veins, into which, as they are considerably more capacious, they rush as into a vortex.

The dilated condition of the vessels is well seen in the accompanying cuts from Hunter. They represent the two ears of a rabbit, one in the natural state, the other inflamed, in consequence of having been frozen and thawed.



They were injected at the same time, and consequently with the same degree of force. Fig. 1 is the inflamed ear; Fig. 2 the natural ear. The vessels in the former are not only much larger than in the latter, but also apparently more numerous; the main artery in the one is likewise greatly increased in size, while in the other it is hardly distinguishable.

Fig. 1.



Fig. 2.



Such are the initial steps of inflammation. If the process be now checked by the removal of the exciting cause, the phenomena referred to gradually disappear, and the part recovers its natural tone and condition.

If, on the other hand, the inflammation be allowed to proceed, another series of changes may be witnessed, surpassing, if possible, in point of interest, those just described. The circulation now completely ceases; the blood assumes a dark modena color, and the coats of the vessels are rendered so soft as to be liable to give way on the slightest force. With these alterations the healthy functions of the part are suspended: it is red, hot, painful, and tumid; and its molecular intervals are filled with serosity, lymph or pus. In this stage of the malady, the capillaries contain thick, viscid, partially clotted blood, which adheres with great tenacity to their inner surface, and opposes an effectual barrier to artificial injection, or to the removal of the fluid by pressure or ablution.

In violent cases the blood breaks through the diseased vessels, and forms slight ecchymoses, as in Fig. 3, from Hunter, representing a magnified portion of inflamed serous membrane. The same appearances are seen in the inflamed web of the frog in Fig. 4, from Marshall Hall. Occasionally, again, the blood escapes from the vessels, and forcing its way along the cellular tissue, forms new channels, through which it afterwards continues to circulate. This interesting phenomenon, which has been frequently noticed by Kaltenbrunner in the inflamed mesentery of the rabbit, is strictly analogous to what occurs in the organization of adventitious membranes, a subject to which the attention of the reader will be subsequently directed.

Fig. 3.



Fig. 4.



Inflammation, it will thus be seen, is a gradual process, which is preceded and accompanied by certain stages. Of these, three are recognized by Kaltenbrunner. The first he denominates the stage of incubation; the second, the stage of congestion: the third, the stage of inflammation, properly so called. Each of these is characterized by particular phenomena, the most important of which have been already described, in the order, as nearly as may be, in which they appear. To this arrangement I can see no special objection: it should be recollected, however, that it is altogether artificial, and that the stages which it recognizes are frequently so blended as to render it impossible to distinguish them from one another. Contrary to what might be inferred from analogy, Kaltenbrunner has ascertained the singular fact, that more time is usually required for inflammation to be developed in highly vascular organs, as the lungs and peritonæum, than in parts in which the circulation is more tardy and less perfect, as the liver and kidney. It is worthy of remark, however, that when the disease is once fairly established, it progresses much more rapidly in the former than in the latter of these structures.

Another striking phenomenon is the distended condition of the larger vessels leading to the inflamed part. (See Fig. 1.) When the disease is at its height, the congestion often extends to a considerable distance; the blood is unnaturally dark, thick, and viscid, and artificial injection is difficult, sometimes impracticable. It has been alleged that the larger arteries in the immediate neighborhood of the lesion occasionally pulsate with preternatural force and frequency; but this is an assertion which is unsupported by proof, and which is, moreover, in direct opposition with every principle of physiology. The intensity of the morbid action is generally greatest at the centre of the inflamed part, from which it gradually, and, in some instances, suddenly diminishes, until it loses itself in the circumjacent textures.

Having thus finished the notice which it was proposed to take of the anatomical characters of inflammation, it will only be necessary, in concluding this part of the subject, to allude to the principal circumstances which are capable of producing congestion and discoloration of the different organs and tissues, immediately prior to, during, or subsequently to, the extinction of life. In a practical point of view, not less than in a pathological, this is a matter of no trifling moment, yet one concerning which there still prevails a great deal of misapprehension in the minds of medical men.

The causes under the influence of which congestion and discoloration may be produced before death, are referable, first, to mechanical obstructions,

interfering with the free return of the venous blood ; and, secondly, to the effects of stimulating agents, introduced into the body either as food, drink, medicine, or poison. The latter of these will be examined in another place, and it will therefore only be necessary, on the present occasion, briefly to inquire into the character of the former.

Whatever has a tendency to interrupt the passage of the blood to or from the heart, must be a cause of congestion in the organ where the accumulation takes place. The obstruction, which may exist in any part of the body, may be produced by a great variety of circumstances, as the presence of a tumor, some morbid deposit, or the obliteration of a large vessel. But the more common source of it, perhaps, is organic lesion of the heart, particularly of its valves, of the auriculo-ventricular apertures, or of the mouth of the aorta or pulmonary artery, opposing the progress of the blood, and throwing it back upon other viscera, which thus receive an undue supply of it. That congestion may, and often is, produced in this manner, is too well known to admit of dispute ; but it is by no means so clear that it does not, inasmuch as it is of a permanent nature, give rise to results very different from those we are now contemplating, — in a word, that it does not lead to inflammation, or to what Andral has termed active hyperæmia. However this may be, it seems to me that pure, uncomplicated congestion, in whatever parts of the body occurring, must uniformly depend upon one or other of the following circumstances : 1. Obstruction of the heart and great vessels, by the formation of fibrinous concretions during the last struggles of life. 2. Partial paralysis of the heart, disqualifying it, to a greater or less extent, for carrying on the circulation. 3. Asphyxia, whether induced by actual strangulation, the inhalation of deleterious gases, or difficult dissolution in ordinary sickness.

The congestion produced by the first two classes of causes is generally partial, and is almost always limited to the more dependent situations ; that, on the contrary, which results from asphyxia usually pervades the whole body, and is particularly conspicuous in the skin, the conjunctiva, the mouth and lips, in the lungs, the heart, and the great vessels, which are often distended, to their very utmost, with black fluid blood. In either case, the resultant discoloration is of a dull bluish tint, as well as much more uniform than in inflammation.

The causes which operate in the production of congestion and discoloration after death, are the gravitation of the blood, and the transudation of this fluid, or of some of its component elements, through the parietes of the vessels.

It is well ascertained that, with the cessation of life, the blood, in obedience to the laws of gravity, gradually subsides to the more depending structures, distending their vessels, both large and small, and imparting to them its peculiar colour. Under ordinary circumstances, these appearances are most conspicuous in the posterior parts of the body ; but observation has fully shown that they may be produced in any situation, laterally, in front, or behind, simply by placing the subject in a particular position, and keeping it there until it is deprived of its warmth. The congestion thus arising is limited, in great degree, to the veins, which are often as thoroughly distended as if they had been filled with injecting matter : they spread out in an arborescent manner, and are generally traceable to large trunks, which are themselves frequently quite full of blood. Their contents are of a dark modena colour, perfectly fluid, or partly fluid, and partly coagulated, and easily pressed from one place to another ; the reverse of which, as before stated, is the case when the congestion depends upon inflammation. At what period the injection begins has not been accurately determined : there is reason, however, to believe that it frequently commences several hours, or even days, prior to dissolution. In



the generality of instances, as is well known, the approaches of death are gradual; one organ fails, as it were, after another, and whilst some parts are still actively engaged in the discharge of the duties which nature has assigned to them, others have either ceased to act, or have become so crippled as to be able to perform their functions only in a tardy and imperfect manner. Under such circumstances, observation warrants the presumption that the blood, from the feeble impulse exerted upon it by the heart, the central organ of the circulation, accumulates in the more dependent parts of the body, in a mode calculated to produce local congestion, with a corresponding augmentation of colour, long before the solids and fluids are consigned to the influence of decomposing agents.

The structures which are more particularly liable to be affected by this kind of injection, are the posterior portions of the lungs, of the liver, and of the kidneys, for the reason not only that these organs are highly vascular in the normal state, but that the individual usually lies upon his back, both after and for some time previously to death. For the same reason, the skin of the back part of the neck, trunk, and extremities is always much more loaded with blood than at the sides or in front, where the cutaneous vessels are comparatively empty. The accompanying discoloration varies with the nature of the affected tissues, from slight rose to deep red, as in the most intense inflammation. Ordinarily, however, it is very faint, more uniform, and diffuse than in disease, and much more easily removed by pressure and ablution.

The second cause capable of imparting an abnormal color to the animal textures after death, is the transudation of the blood through the parietes of the vessels. It is a law of the healthy economy that the vessels shall retain the fluid which is destined to pass along them without suffering permeation; but no sooner is the vital principle withdrawn than the body is brought under the influence of surrounding agents, which speedily change the relations of its various component elements, and impress upon them a total alteration of character. Amongst these, the most important, in connection with the present topic, is the percolation of the blood through its vessels, and its diffusion through the solids, by which the latter are rendered unnaturally red and moist, as if they had been steeped in some colouring liquid. The redness thus produced, as it almost always depends upon putrefactive decomposition, rarely appears within the first four-and-twenty hours after death, unless there is a very high degree of summer heat conjoined with atmospheric humidity. Nor does it occur with equal facility or frequency in all parts of the body: the structures which are soonest and most extensively affected are, the endocardiac lining and the internal tunic of the arteries and veins, where it is often mistaken for that of inflammation. To this, however, it bears only a very remote resemblance. It is usually a mere scarlet stain, as if it were attached to the free surface of the membrane, over which it is generally uniformly diffused, without any particular alteration in the subjacent parts, or any deposit upon the interior of the tube. Sometimes the redness occurs in bands, patches, streaks, points, or arborescent lines, with intervals retaining the ordinary appearance. The latter variety is frequently observed along the course of the larger veins of the stomach and bowels, in warm, wet weather, when the examination is delayed beyond thirty-six hours. Similar phenomena are occasionally witnessed, under like circumstances, in the skin of the back part of the body, particularly in those regions which are subjected to pressure. Finally, as the process of decomposition advances, the discoloration, losing its scarlet character, assumes a muddy, brownish aspect, with various tints of green, and, at the same time, pervades, to a greater or less extent, all the softer textures of



the body. These changes take place, all other things being equal, much sooner in warm than in cold weather, and in full, plethoric individuals, than in such as die in a state of general anæmia.

Exposure to the air is another cause of cadaveric coloration, which demands brief consideration in reference to the present subject. This variety of redness, which generally begins to appear within a very short time after the removal of the organs from the body, always proceeds with great rapidity in warm weather, especially when the part is brought under the direct influence of the solar rays. The structures in which it is most commonly observed, are the spleen, liver, kidney, and heart, the internal tunic of the arteries and veins, and the mucous membrane of the alimentary tube. In nearly all these situations, the color is of a bright scarlet, like that of arterial blood, and uniformly diffused over the whole, or the greater portion, of the organ in which it occurs. In the stomach and bowels, it occasionally presents itself in small florid specks, as if the surface of the lining membrane had been sprinkled with vermilion. Absorption of the oxygen of the air, and the admixture of this gas with the blood, are the causes, undoubtedly, under the influence of which this species of coloration is established. Hence, by exposing the affected organ, for a few minutes, to a gentle stream of water, or immersing it in diluted vinegar, it almost instantly changes its florid appearance, and assumes a dark purple hue, similar to that of venous blood.

Such are the varieties of congestion and discoloration, resulting from causes which exert their influence during the last moments of existence, or within the first few days after death. Although, in general, easily distinguishable from those of inflammation, yet it must be confessed that the diagnosis is sometimes extremely difficult, if not impossible, so closely do they run into each other. Under such circumstances, a careful analysis of the symptoms of the case, with the effects of the remedies employed, and an attentive consideration of the ordinary products of morbid action, are absolutely indispensable to a correct appreciation of the nature and character of the supposed lesion. Should there be merely some degree of redness, with ramiform injection, traceable to some large venous trunk, unaccompanied by effusion, softening, opacity, induration, thickening, or ulceration, the presumption is strong that these appearances are the result solely of congestion, produced by some one or more of the causes previously pointed out. If, on the other hand, the discoloration and vascularity are associated with some, or all, of the anatomical characters here indicated, it must be concluded that they are dependent upon inflammatory irritation, since they afford the best possible evidence of the existence of the lesion.

Can inflammatory redness exist during life, and yet entirely disappear after death? This is a question, undoubtedly, of no little moment, in a practical point of view, which will be duly considered when we come to speak of the anatomical characters of inflammation of the mucous membrane of the alimentary tube.

After what has been stated, it will not be expected that we should say much respecting the various theories, or, rather, hypotheses, that have been projected in relation to the proximate cause of inflammation. A few only of the more prominent will be noticed. The first which I shall mention is that of Boerhaave, which supposes that the disease essentially consists in an obstructed state of the capillaries, produced by some morbid lentor of the blood, or by the entrance of the red globules into vessels not fitted to receive them. This opinion rested on the belief that the sanguineous particles are remarkably complicated in their structure, each red one consisting of six serous, and each serous of six

lymphatic ones, for the conveyance of which three kinds of tubules were imagined, as channels of communication between the arteries and veins. By getting into a wrong vessel, the globules might very readily produce obstruction, and thus excite inflammation.

The late Dr. Cullen, of Edinburgh, not less distinguished for his eloquence as a teacher than his ability as a writer, conceived the idea that inflammation was merely a sort of spasmodic contraction of the small vessels, interrupting the passage of the blood. This state, he supposed, was sometimes the effect of direct debility; and he imagined, moreover, that there was frequently a peculiar condition of the whole vascular system, which predisposed to this affection, and which received from him the name of the *phlogistic diathesis*. This theory, notwithstanding the favorable manner in which it was for a long while regarded, has the disadvantage of being unsupported by a single fact. So far from the vessels being contracted in inflammation, it is now well ascertained, as was before mentioned, that they are invariably dilated, and that, in consequence of this, they always admit an unusually large amount of blood, which could not happen were the reverse of this the case.

Dissatisfied with the crude conjectures of Boerhaave, Cullen, and other writers, another theory was proposed by Dr. Vacca, an eminent Italian pathologist, soon after the middle of the last century. In his treatise on inflammation, published at Florence, in 1765, he maintains the opinion that this disease invariably results from sanguineous congestion, attended with more or less debility of the affected part. The first step in the process is relaxation of the capillary vessels, which allows them to be abnormally distended by the blood that passes through them. To this increased quantity of fluid he ascribes the redness, heat, pain, and turgescence, which are always more distinctly marked in proportion to the dilatation of the minute arteries and veins, the violence of the exciting cause, and the natural vascularity of the part concerned.

Since the time of Vacca, the theory of diminished power of the vessels has been warmly advocated by a considerable number of pathologists, especially by Dr. Wilson Philip, Dr. Hastings, and Dr. Thomson. The experiments which were performed by these distinguished writers, although they are at variance as respects some trifling points, all tend to show that inflammation essentially consists in a weakened action of the capillaries, by which the balance between them and the large vessels is destroyed, and congestion is the result. Opposed to these views, again, are those of Mr. Hunter and Dr. Gendrin. These pathologists have both minutely investigated the subject of inflammation in all its departments, and they adopt the belief that the primary cause of the disease is an increased action of the vessels. Amidst such discrepancy of opinion, it might seem, at first sight, extremely difficult, if not impossible, to arrive at any satisfactory conclusion. To me, both views appear to be correct, but not in the sense advocated by their respective authors. In the early stage of the disorder, we have every reason to believe, from the phenomena which are exhibited under the microscope, that the vessels have an augmented action; subsequently, however, when the disease is fully established, the capillaries are partially paralyzed, the blood ceases to circulate, the function of nutrition, secretion, and absorption, is interrupted, and every thing indicates the diminished power of the part.

Dr. Bennett, of Edinburgh, has recently attempted to show that inflammation is merely a deviation from healthy nutrition. As in the natural state, the sanguineous liquor, as it is termed, exudes through the capillaries into the interstices of the tissues, furnishing materials for the development of the various textures, so in inflammation the fluid in question passes from the dilated vessels

of the affected part, and forms germs for the development of morbid cells, which may lead to the production of pus, to an analogous substance, or to a cancerous growth. Inflammation, according to this view, is synonymous with abnormal nutrition, in which the cardinal symptoms of the disease, namely, heat, pain, redness, and swelling, are merely consequences of the antecedent engorgement and concomitant effusion. The theory of Dr. Bennett does not, in my judgment, throw any new light upon this intricate and mysterious subject, but leaves it precisely where it was. It has been long known that in every well-established inflammation there is "perverted action," with altered exudation, and no pathologist ever supposed that the phenomena usually enumerated as characterizing the process were any thing more than effects, consequences, or manifestations of the morbid action which precedes and accompanies it.

Liebig ascribes the essential cause of inflammation to an unusually rapid union of the oxygen of the arterial blood with the tissues of the inflamed part; Henlé to a paralysis of the capillaries; Macartney to a sense of injury felt by the organic nerves; Wharton Jones to an unnatural attraction of the red globules for each other, and for the sides of the minute vessels.

Finally, inflammation ends in different ways. When it gradually subsides, without any untoward occurrence, it is said to terminate in resolution. In some cases it relieves itself by an effusion of serum and lymph, by suppuration, by hemorrhage, and by softening. At other times, the part loses its vitality; and it is then said to end in gangrene. Philosophically speaking, some of these states are merely *conditions*, not terminations of inflammation. Thus, suppuration is absolutely, from first to last, a phlegmasial process; and so of softening, the effusion of serum, and the deposition of lymph. It is therefore rather in compliance with professional usage than with the sound principles of pathology, that we should continue to employ this vague expression.

With respect to acute inflammation, the following terminations may be recognized: 1, resolution; 2, effusion of serum; 3, deposition of lymph; 4, suppuration; 5, hemorrhage; 6, softening; 7, gangrene. These different terminations constitute merely so many degrees of inflammation. Thus, suppuration indicates a higher grade of action than lymphization, and a milder one than hemorrhage, softening, or gangrene. We might thus construct a sort of *phlegmasial scale*, the index of which would be the product of the disease, or the mode in which it terminates.

The various depositions which attend the inflammatory process are an effort of nature to relieve the morbid action; or, what is the same thing, to unload the vessels, and remove oppression. "It is," to use the language of the learned Professor Paine,\* of New York, "nature carrying on the work of depletion in the very instruments of disease, whilst, as in the effusion of lymph, she may simultaneously accomplish another great final purpose." Effusions seem to relieve vascular distention upon the same principle as the abstraction of blood by the lancet, by purgatives, and by other evacuants. Catarrhal affections of the nose often speedily disappear the moment there is a free discharge of mucus; a deposit of serum may put a sudden stop to a pleuritis; and a violent enteritis is sometimes cured in a few hours by a copious hemorrhage from the bowels. The manner in which suppuration modifies and arrests inflammation has long been familiar to pathologists.

Chronic inflammation has fewer terminations or conditions than the acute. The principal ones may be thus stated: 1, ulceration; 2, granulation; 3, cicatrization; 4, induration. Besides these conditions, chronic inflammation may occasionally be attended with hemorrhage and softening, or even terminate in

\* Medical and Physiological Commentaries, vol. ii, p. 330. New York, 1840.



gangrene. These occurrences are, however, extremely rare, and are seldom witnessed except when there is a sudden supervention of acute disease. Let us now proceed to describe these different states in the order in which they are enumerated.

## CHAPTER II.

### OF THE EFFUSION OF SERUM.

Occurs, to a greater or less extent, in almost every inflammation. — *Œdema*, *anasarca*, and *dropsy*. — Color, consistence, quantity, and chemical composition. — Usually the result of a mild degree of inflammation. — Conclusion.

AN effusion of serum, to a greater or less extent, occurs in almost every inflammation. There are some varieties of this disease in which, indeed, it forms the chief if not the only symptom. It is seen most frequently in the interstices of the cellular tissue, on the surface of the serous membranes, in the parenchymatous texture of the lungs, in hydatids, and serous cysts. There are some structures which, from their dense and compact nature, do not seem to admit of this infiltration. Of this description are the liver, kidney, womb, prostate gland, and spleen, together with the tendons, aponeuroses, ligaments, cartilages, and bones. Very little serum is effused by the brain, spinal cord, nerves, vessels, and mucous membranes. With respect to the latter, the parts most frequently and extensively affected, are the margins of the glottis, the conjunctiva, the prepuce, and the nymphæ. Considered in reference to the subcutaneous cellular tissue, the effusion occurs much more frequently in the inferior extremities than in the superior; in the genital organs than in the trunk; in the eyelids than in the face, head, or neck. The lymphatic ganglions and the inter-fibrillar substance of the muscles are often the seats of considerable serous infiltrations, especially in weak cachectic subjects, or those who are worn out by severe and protracted diseases. Large quantities of this liquid are frequently discharged by the mucous membrane of the bowels, in diarrhœa and cholera. In the skin the most striking exemplification of this effusion is seen in the vesication of an ordinary blister, in burns and scalds, and in the elevation of the cuticle which announces mortification.

Various names are employed to designate these effusions. When the fluid is poured out into the interstices of the subcutaneous cellular tissue, it forms a smooth, pale, glossy swelling, which pits on pressure, and is seldom painful, unless there is considerable inflammation. This is called *œdema*. When this affection occurs in the extremities, it generally varies with the position of the body, being very slight or entirely absent when the limb is elevated, and most prominent when it is dependent. The reason of this is obvious. In many cases the fluid is not developed in these parts, but gravitates thither from other regions, making passages for itself through the cellular tissue. As meaning the same thing, the term *anasarca* is sometimes used. The word, however, is generally employed in a more comprehensive sense, to designate the effusion of serum into the meshes of the cellular tissue, in whatever part of the body this structure exists. When the collections occur in the serous sacs, they are called *dropsies*. These, again, are named according to the particular cavities in which they are found. Thus, an accumulation of water in the arachnoid is denominated *hydrocephalus*; in the spinal canal, *hydrorachitis*; in the pleura, *hydrothorax*; in the pericardium, *hydropéricardium*; in the peritonæum, *hydroabdominalis*; in the vaginal tunic, *hydrocele*; and *hydrarthrosis*, in the articulations.

The color and consistence of the effused fluid are liable to considerable diversity. In some situations, as in the arachnoid membrane and subcutaneous cellular tissue, it is clear and limpid, like the purest spring water; in others, it is more or less viscid, of a pale yellowish tint, and contains flakes of fibrin. A lemon-colored serum is not of unfrequent occurrence in the chest, the vaginal tunic of the testicle, and in the articulations of the extremities. Occasionally the fluid is of a pale reddish color, from the admixture of hæmotosine, and cases are witnessed where it has the aspect and consistence of coffee-grounds. The latter variety is particularly common in inflammation of the peritonæum, caused by strangulation. In jaundice, it sometimes contains a yellow coloring matter, like that of the bile: it has also been found impregnated with cholesterine and uric acid.

Of the chemical composition of this fluid very little was known until within the last thirty years. For the most important information concerning it, we are principally indebted to Dr. Marcet, of England, to whom animal chemistry generally is under so many obligations. This distinguished physician has developed the interesting fact that serous liquids, no matter what may be the structure of the organ or tissue furnishing them, are essentially of the same nature. According to the statement which he has published in the second volume of the London Medico-Chirurgical Transactions, the prevailing animal substance is albumen, with a minute quantity of muco-extractive matter, which is uncoagulable, but soluble in water and other fluids. In none of his experiments did he detect any gelatine. The proportion of albumen is subject to much variety, being very abundant in some situations, and almost entirely wanting in others. The principal saline ingredients are soda and potash, in the form of muriates and sulphates, with phosphate of lime, iron, and magnesia. The specific gravity of the effused liquids is generally less than that of the serum of the blood, and their coagulability is always in direct ratio to the amount of albumen. In the fluid of hydrocephalus and spina bifida the quantity of this substance is frequently so small as scarcely to be rendered visible by heat, alcohol, or acids. From all, then, that we know concerning this matter, it may be legitimately inferred that it is perfectly identical with the serum of the blood from which it is derived, differing from it only in specific gravity, and in the relative proportion of its constituents.

The amount of fluid varies from a few drops to several gallons. The rapidity with which it is poured out, even in large quantity, is sometimes surprising. In persons bit by venomous serpents, the whole body often attains an enormous size in the course of a few hours from this source, and some of the internal organs are literally inundated. Usually, however, the effusion takes place more gradually, and never to any considerable extent until the inflammation has attained a certain point. Let me be comprehended. In the serous membranes, which afford this fluid in greatest abundance, one of the first things that happen, when they are irritated, is the suspension of the natural secretion, which is restored and augmented only after the violence of the inflammatory impulse has somewhat abated. If this should not occur, lymph, not serum, will be furnished, either alone or combined with pus or blood; or the individual, the subject of the disease, will perish from its effects; or the part will fall into a state of sphacelus.

It has been already hinted that serous effusion is the result of inflammation, usually of a very mild grade. That this is true, as a general rule, cannot be doubted; the exceptions, if there be any, are certainly very rare, and have not yet been satisfactorily pointed out. A few facts, clearly and concisely stated, will materially assist in determining this problem.

It has been alleged, in the first place, that serum is occasionally effused

when there is an obstacle simply in the circulation, without any concomitant inflammatory action. It is a matter of common observation with the physician, that anasarca of the lower extremities often arises from obliteration of the femoral, external iliac, and ascending hollow veins; and the face, neck, and arms are frequently loaded with serum from compression of the vessels which return the blood to the right side of the heart. When the portal vein, or any one of its principal branches, is obstructed, abdominal dropsy, or ascites, follows. Contraction of the right auriculo-ventricular orifice, or disease of the valves of the pulmonary artery, impeding the passage of the blood, and compelling it to regurgitate into the inferior cava, produces the same result, together with œdema of the legs and feet. These examples will be sufficient for the subject which they are intended to illustrate. Let us now endeavor to ascertain how far they are dependent upon inflammation, or whether they are the result merely of mechanical obstruction? It is frequently extremely difficult to ascertain the condition of the seat of the effusion by anatomical inspection. In ascites how often does it happen that there is the most copious accumulation of water, caused obviously by inflammation, and yet, on examination after death, there is scarcely a single trace of the latter malady? That there are cases, then, of serous effusions, in which the ordinary phenomena of phlegmasia, particularly the discoloration, entirely vanish on the approach of death, or during the last struggles of life, cannot be doubted; indeed, it is not improbable that there are instances in which this disparition occurs long before the individual expires. The absence of redness, therefore, does not prove that there was no inflammation; for the existence of this lesion is sufficiently evinced by the presence of the watery accumulation, and the opacity of the affected membrane. Should there be, in addition, specks, patches, or bands of fibrin, all doubt on the subject must vanish.

Such, then, being the difficulty of recognising the presence of inflammation, where every symptom during life gives indubitable evidence of its existence, can it be wondered at that, in the instances above referred to, pathologists should still consider the effusion of serum as the result merely of mechanical obstruction? The question may now be asked, can such an obstruction exist, to any considerable extent, without producing a state of parts analogous to, if not really identical with, inflammation. I would answer, no. Let it be supposed that the obstacle exists in the ascending hollow vein. This vessel is destined to return the blood from the inferior extremities, the pelvis and abdomen, to the right side of the heart. But, failing in the accomplishment of this object, from the difficulty adverted to, the blood is interrupted in its passage upwards, and congestion of all the vessels, both large and small, is the result. This congestion is not transient, but permanent; and it is scarcely reasonable to presume, judging from our knowledge of the circulation, that this state could exist long without producing an altered condition of the sensibility of the parts affected, attended with more or less redness, and effusion of serosity. The peritonæum and cellular tissue of the limbs are the structures which bear the onus of the obstruction, and these, it is well known, are parts which are most liberally supplied with serous capillaries. But, it may be said that the effusion may result from perverted action, from irritation, or disturbed function: all this may be true, and yet not in the least invalidate our position. Every body knows that in inflammation there is perverted action, or deranged function, with irritation, or altered sensibility. These terms, therefore, if they mean anything at all, only denote certain conditions, not the cause of these conditions; as redness, heat, pain, and turgescence are not inflammation, but only so many symptoms of it.

The preceding remarks are equally applicable to those watery effusions of



the serous textures, which occur in association with organic diseases of the glandular and parenchymatous viscera. A large scirrhus tumor of the liver, seated so superficially as to encroach upon and fret its serous investment, is often attended with ascites, although the portal circulation is in no wise obstructed or embarrassed. In the same manner hydrothorax is sometimes induced by tubercles of the lungs; hydrocele by carcinoma of the testicle; hydrocephalus by heterologous growths of the brain. In all these instances the effusion of water is the result, unquestionably, of inflammation, lighted up in the serous covering of the respective organs, by the morbid deposit acting in the capacity of a foreign substance. The dropsical accumulations which supervene upon scarlet fever, measles, and other eruptive diseases, can be traced, in most cases, directly to phlegmasial irritation of the serous membranes.

Taking into consideration the preceding facts, and the reasoning founded upon them, the conclusion is obvious that the effusion of serosity, no matter in what part, organ, or region it occurs, is the result, *invariably*, of a process analogous to, if not strictly identical with, inflammation. This process, we repeat it, is often very imperfectly marked, both during life and after death, so that the ordinary phenomena of phlegmasia are in no way manifest to our senses.\*

### CHAPTER III.

#### OF LYMPHIZATION.†

Always the result of Inflammation. — Physical properties of Lymph. — Quantity. — Varieties of Form. — Chemical Constitution. — Period at which the Deposition commences. — Has a tendency to become organized. — How this is effected. — Analogous Tissues. — Use of Lymph as a means of Restoration. — Adhesive Action.

IF there be still some doubt as to the question, whether effusion of serum is invariably of inflammatory origin, there can surely be none respecting that of fibrin. So true is this, in reference to the latter product, that it may be assumed as a law, than which there is none more satisfactorily established in pathological science. Yet, as in the former case, examples not unfrequently occur where the fibrin constitutes the only sign which is to be observed after death, of the previous existence of inflammation. In arachnitis, large quantities of this matter are often poured out, without our being able to detect the slightest redness, opacity, or thickening of the serous membrane. Nevertheless, would it not be the height of absurdity to say that, because any of the ordinary phenomena are wanting, there had been no inflammation?

\* "If there be," says a most erudite and philosophical writer, "any dropsical effusions that are not induced by inflammation, or a morbid action consequent upon it, or in other respects analogous, let us have something besides an unmeaning 'debility of the vessels,' or, what is the same thing, a process of 'filtration.'" (Dr. Paine's *Med. and Physiol. Commentaries*, vol. ii., p. 557, New York, 1840.) "A careful attention to all the circumstances attending dropsies, whatever the nature of the remote cause, whether specifically morbid or the stimulus of vascular distention, results in our conviction of the simplicity of nature's operations, and that she has in those affections but *one fundamental principle*. We certainly need not expect lesions of structure nor vascularity in the peritoneal or cellular tissues, where one is prevented, and the other, if it have existed, may be fully overcome by the effusion. Daily observation evinces the fact that depositions of serum arise from low states of inflammation, or a morbid state approaching, or consequent upon it, especially when this action is under the influence of habit." *Op. cit.*

† As this term is not to be found in any of our pathological treatises, it is necessary to observe, that it is employed here in the same sense as "effusion of lymph" or "deposition of fibrin." We say a part is in a state of suppuration when it is secreting matter: with the same propriety we may say that a structure is in a state of lymphization, when it is pouring out lymph, gluten or fibrin.

Lymph is a vital, organizable substance, separated from the blood by a process of secretion, similar in kind to, but different in degree from, that which presides over the elaboration of serum and pus. In its physical properties it is liable, like other morbid products, to be modified by adventitious circumstances, and hence it does not always exhibit the same appearance. In general, it is transparent, and of a white, yellowish-white, or opaline tint; but it may be opaque, cineritious, milky-white, or reddish. In jaundice, I have seen it of a pale yellowish hue, from the presence of the colouring matter of the bile. At first it is very soft, semi-liquid, or almost diffuent, and so viscid that it may be drawn out into thin filaments; but it gradually increases in consistence, assumes a retiform arrangement, and feels very much like a mass of cobwebs moistened with water. When squeezed, it yields a small quantity of fluid identical with the serum of the blood. If the circumstances under which it is deposited are favorable, it is either absorbed, or a part of it remains, becomes organized, and is rendered capable of being converted into a great variety of tissues, such as the cellular, serous, fibrous, cartilaginous, and even the osseous. The period necessary for these transformations varies from a few weeks to as many months.

Under the microscope, the mass of lymph is found to be composed of a great number of globules, connected together by a transparent matrix, and pervaded by exceedingly minute granules. The globules are of the same size as those of pus, and are at first very loose in their texture, but become gradually more dense and compact. In many cases, the substance consists of delicate fibrils, straight, transparent, running parallel with each other, and interspersed with small granules. The first step towards organization in the structureless lymph is the arrangement of the granules, through their own vital impulse, into groups of nuclei, which are converted into cells, termed *cytoblasts*, from which the future tissue is formed. The process, in fact, is the same in principle as that by which the textures, furnishing the new product, are themselves originally developed.

Fig. 5.



Fig. 6.

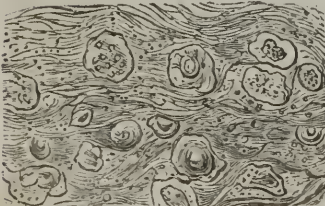


Fig. 5 displays a portion of recently-effused lymph, opaque, white-coloured, friable, and magnified about 380 diameters, from traumatic inflammation of the peritonæum of a horse. It is composed of globules, smaller molecules, and granular matter in a hyaline matrix. In the lower part of the figure the granules and molecules are shown as floating in serous fluid. In Fig. 6, the structure of the effused matter is somewhat more advanced. It forms, in fact, a sort of false membrane, magnified 800 diameters. Numerous corpuscles are seen, more or less globular, and having the character of primary cells; the intervening texture is formed of most delicate fibrils. A few minute granules are interspersed through the tissue.\*

The *chemical composition* of lymph, like that of serum, is essentially the same in whatever part of the body it is deposited. Andral and Gavarret have fully proved that the quantity of fibrin is increased during inflammation, and that

\* Gulliver, Appendix to Gerber's General Anatomy, Pl. p. 59—65

the proportions of this substance bear a close relation to the degree of the morbid action. The recent researches of Lassaigne have thrown additional light on this interesting subject, by showing that the false membranes of the serous and mucous cavities are composed mainly of fibrin, with a small quantity of soluble albumen and a yellow-colored serum, containing all the organic and saline elements of the blood. Immersed in alcohol, or a strong solution of corrosive sublimate, the effused matter becomes dense and firm, and assumes a whitish, shrivelled aspect. In water it is gradually decomposed, and broken up into small, dirty, rotten-looking fragments, which readily yield under the pressure of the finger. This substance thus appears to be, in all respects, similar to the buffy coat of the blood, being separated from the vessels by a secretory process, which rejects the colouring and fatty principles of that fluid, while it permits others to escape along with it.

Lymph is effused under a considerable variety of *forms*, depending upon the peculiar shape of the part which supplies it. In the subcutaneous cellular tissue it usually occurs in small amorphous masses, sometimes in disseminated globules. In the larynx and trachea, it accurately moulds itself to those cavities. In the peritonæum, it forms bands, occasionally of considerable length, which extend from one coil of bowel to another; in the pleura it is commonly laminated. To these statements there are, of course, numerous exceptions, which will be adverted to in other parts of this treatise.

The amount of fibrin poured out is subject to much diversity. In general it is furnished most abundantly by the serous sacs; yet, under certain circumstances, large quantities are effused by the mucous membranes of the respiratory and intestinal tubes, as well as by that of the œsophagus and uterus. Happily, however, this substance rarely remains long in these outlets; otherwise the most serious consequences might ensue. As it is, in the trachea it often produces death, by preventing the ingress of the atmosphere; the lachrymal passages, and many of the minute bronchial canals are sometimes obliterated by it; in the urethra it lays the foundation of permanent stricture; and in the chest, by tying down and compressing the lungs, it may give rise to atrophy, or otherwise embarrass the respiratory function.

Considerable quantities of fibrin are not unfrequently found on the inner surface of the arteries, the largest sized trunks of which are occasionally obliterated by it. The muscles, fibrous membranes, the tendons, ligaments, cartilages, and bones yield very little when in a state of inflammation. The skin, the veins, and absorbents furnish it also very sparingly. A good deal is generally effused in phlegmasia of the subcutaneous cellular tissue around abscesses, and upon the walls of fistulous passages. With respect to the parenchymatous and glandular organs, the effusion of fibrin may be said to be in direct proportion to the amount of cellular substance which enters into their composition, being always very small where their structure is dense and compact, more or less copious where it is soft and lax.

The period at which the deposition of lymph commences is influenced by different circumstances, the principal of which are referable to the intensity of the inflammation and the nature of the affected structure, tissue, or organ. In some experiments which Dr. Thomson,\* of Edinburgh, made on the inferior animals, a distinct layer of lymph was seen covering the incisions within less than four hours after they had been inflicted; and in a young man who died last summer of a gun-shot wound, which penetrated the liver and diaphragm, I found both the pleura and peritonæum extensively coated with this substance nine hours

\* Lectures on Inflammation, p. 168. Phila. 1831.



after the reception of the injury. In many cases there is reason to believe that the effusion takes place almost at the very onset of the inflammation, and that it proceeds with greater or less rapidity until the disease either abates, passes into suppuration, assumes a chronic form, or destroys life.

If this substance remains undisturbed, it manifests a disposition to become organized. The period within which this happens varies from a few hours to several weeks. Mr. Hunter relates a case in which the adhesive matter was organized in twenty-nine hours. He operated on a man for strangulated hernia, and death took place at the end of this time. No lymph was seen in dividing the stricture; but on the post-mortem examination a small quantity of this substance was discovered on the surface of the recently protruded bowel, and was so completely vascularized as to admit the fine injecting matter thrown into the vessels of the affected tube. The serous sacs are the situations in which the organization is accomplished with the greatest ease and rapidity; while in the mucous canals it either does not take place at all, or very imperfectly, and only after a long time. It is likewise effected with great facility in the skin, in the cellular tissue, and in fractured bones. The vascularization of the effused substance is greatly influenced by the state of the constitution, by the nature of the pre-existing texture, and, above all, by the amount of its own inherent vitality. When this is of a low grade, the lymph either dies, and thus becomes a source of mischief, or it undergoes a slow and imperfect conversion into an analogous tissue.

How this organization is produced is an interesting subject of inquiry, and one which has excited much discussion among pathological anatomists. That it is effected in one of two ways, is sufficiently obvious, — either by the vessels of the natural tissues shooting into it, or spontaneously by powers residing within itself. Proofs are not wanting in support of both views. In removing, for example, a recently formed adventitious membrane, we not unfrequently find its adherent surface marked by numerous bloody points, caused evidently by the rupture of the elongated capillaries of the inflamed normal membrane. What renders this supposition the more probable, is the fact that the free surface of the serous membrane — for it is to this class of textures that these remarks are more particularly intended to apply — is studded with very minute granulations, which are highly vascular, and accurately correspond in their situation with the red dots observable on the attached surface of the new membrane. These granulations become gradually more and more distinct, both on the original and on the adventitious structure; and, by means of a magnifying-glass, very delicate slender vessels, arterial as well as venous, may be seen passing from the substance of the one into that of the other. As the penetrating vessels increase in volume and number, the lymph adheres more firmly to the inflamed surface of the natural membrane, until at length the circulation between them is fully established, being carried on with the same freedom and vigor as in other regions of the body.

The second opinion — that, namely, which supposes the lymph to possess a self-organising power — ranks amongst its advocates some of the most distinguished pathologists of the last and present centuries; and the facts which they have adduced in favor of their position go far, it must be confessed, in leading us to doubt whether this substance, in whatever form it may appear, is ever vitalized in any other way. They have shown, most conclusively, as it seems to me, that portions of exuded lymph contain vessels, and perform the functions of nutrition, secretion, and absorption, before it is possible to trace the slightest vascular connection between them and the surrounding textures. In the pleura, it has often occurred to me to see as many as three, four,

five, and even six distinct layers of this substance, arranged so as to intercept cavities of various sizes, filled with serum, flakes of fibrin, pus, and even blood. In some of the cases, the circumstances were such as to render it perfectly certain, that the development of these adventitious membranes must have taken place with so much rapidity as to preclude the idea that their organization could be effected through the agency of the subjacent serous structure. There is, therefore, reason to believe that lymph possesses, in many instances, an inherent self-creating power, in virtue of which it forms blood which gradually prepares its own vessels. What the precise nature of this vitalizing influence is, we cannot, of course, determine: the difficulty, surely, cannot be solved by invoking, as has been done by Andral, the agency of the electric fluid. Of the intimate character of this fluid we know as little as of life itself; and the notion just alluded to is, therefore, ill calculated to enlighten us on a subject concerning which we must necessarily remain forever ignorant.

The primordial traces of the organizing process consist, according to the theory under consideration, in the appearance of a few red dots, which have been happily compared to the "salient point" in the vitelline membrane of the chick, the fibrin being endowed, as was before stated, with a similar property of generating blood.\* Red furrows, streaks, or lines, are sometimes perceived, shooting out in various directions, which gradually assume the character of distinct vessels, in every respect analogous to those in other parts of the body. In other cases the small sanguineous trains take on a ramiform arrangement, and are ultimately converted into real vascular tubes. At an early period of their development, these trains are found, according to Laennec, to contain minute filaments of fibrin, permeable at their centre, which soon assume a cylindrical shape, and thus constitute the rudiments of the future vessels. These new channels, composed both of arteries and veins, the latter of which, however, predominate as well in volume as in number, gradually extend towards the neighboring parts, with the capillaries of which they finally inosculate, the blood passing freely from the one to the other. In their mode of arrangement, many of these vessels resemble the vena porta; that is, they consist each of a single trunk, usually of considerable length, from each extremity of which are detached a certain number of branches, twigs, and filaments.

Such is an abstract, — too rapid and imperfect, I fear, to do justice to the subject, — of the two principal theories that have been advanced in relation to the manner in which this substance is organized, and rendered "part and parcel" of the living system. Both are highly plausible as well as ingenious, and, perhaps, equally entitled to respect. The probability is that neither is exclusively applicable to all cases. To be at all susceptible of organization, it is necessary that the lymph, at the time of its deposition, should be endued with a certain amount of vitality; for when this is withheld, it will soon be broken down and converted into puriform matter. When, therefore, the exudation is very feebly vitalized at the moment of its secretion, it may be inferred that it can become organized only by the vessels of the surrounding textures sprouting into it; whilst, on the other hand, if it be highly impregnated, if I may so express myself, with the living principle, it may be supposed to be capable of effecting this object by its own inherent powers, without any assistance from the original structures. Be this as it may, it is impossible to avoid the conclusion that coagulating lymph is susceptible of spontaneous organization. Independently of the facts already adduced, the experiments of

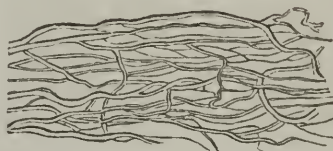
\* Dr. Adair Crawford, *Cyclop. Pract. Medicine*, art *Inflammation*, p. 765.

John Hunter and Everard Home, in which the vessels formed in a clot of blood were successfully filled with injecting matter, place this subject in a most incontrovertible light. Shrøder Vander Kolk,\* detected, with the aid of a magnifying power, numerous vessels, finer than the most delicate hair, and terminating in a cul-de-sac, in a piece of false membrane floating about in the midst of a serous fluid ; it was still soft, gelatinous, and entirely free from adhesions.

Fig. 7.

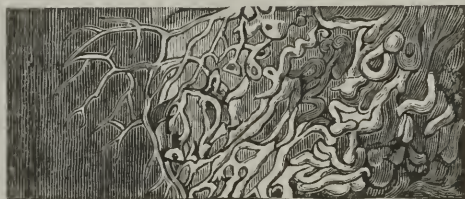


Fig. 8.



The arrangement of the newly-formed vessels is represented in the annexed sketches, from plates by Hunter and Lobstein. Fig. 7 is a portion of coagulating lymph attached by a narrow neck to the peritoneal coat of an inflamed intestine. The vessels have a ramiform disposition, and freely anastomose with each other. Fig. 8 is a piece of false membrane of the pleura. The vessels are large, numerous, and farther advanced than in the other sketch. Fig. 9 affords a good illustration of the vessels of a coagulum of blood, as seen by Hunter and Home.

Fig. 9.



Nothing is known, with any certainty, concerning the *nerves* of this organized matter. So far as my knowledge extends, I am not aware that any anatomist has succeeded in detecting any in the adventitious membranes ; that they exist, however, may be legitimately inferred from the fact that they are capable of executing the highly important function of nutrition, secretion, and absorption, which, but for this circumstance, they could not possibly accomplish. My own opinion is, that plastic lymph, in whatever part of the body it occurs, in its progress towards organization, either generates its own nerves, or receives them from the neighboring tissues, in the coats of the vessels. I am the more inclined to adopt this view from the analogy afforded by some of the primitive textures, as the osseous and cartilaginous, which, there is every reason to believe, obtain their nervous supply in this way. Absorbent vessels also exist ; but their presence, like that of the nerves, has hitherto been a matter rather of inference than of actual observation. Lately, however, Shrøder Vander Kolk†

\* *Observationes Anatomico Pathologicæ et Practici argumenti*, p. 20.

† *London Medical Gazette* for Jan. 1843.



has satisfactorily demonstrated them in the false membranes of pleuritis. His preparations are said to be injected with quicksilver, and to exhibit the characteristic knotty arrangement observable in the lymphatic vessels of the natural tissues.

Whether the plastic lymph, when once organized, remains during life, or whether it is partially or totally absorbed, are points respecting which there still exists a difference of opinion. Most generally it maintains its parasitic existence, though occasionally there is just ground for believing that it disappears. This, at least, would seem to have occurred in the interesting case of a maniac, dissected by the late Professor Beclard\* of Paris. In some of his paroxysms, this individual inflicted upon himself a considerable number of stabs, several of which penetrated the abdomen. In the most recent, the intestine adhered directly to the wounded spots; in another, evidently of longer standing, the union was effected by a small, narrow band; whilst in that which was inflicted first, the bridle was absorbed at the middle, and thereby broken.

Plastic lymph, organized in the manner now described, forms the basis of all the analogous tissues, and the bond of union of divided parts. It may become the seat of inflammation, both acute and chronic; pour out serum, lymph, pus, and even blood; and undergo the same transformations precisely as the natural textures. It is likewise the source of what is termed induration, and probably, also, in a modified form, of scirrhus and tubercle.

The *analogous tissues* formed, as just stated, out of the plastic element of the blood, are nearly as numerous as the natural, to which, as their name imports, they bear the closest resemblance in the threefold respect of physical, chemical, and vital properties. The following arrangement embraces the different kinds of textures pertaining to this class which have hitherto been described by authors: cellular; serous; mucous; cutaneous; vascular, including the erectile; adipous; horny, including the cuticle, hair, and nails; fibrous; fibro-cartilaginous; cartilaginous; osseous. These tissues will be described in their appropriate place. In the mean time, it may be remarked concerning them, generally, that they do not occur with equal facility; that they are more prone to arise in the old than in the young; and that whilst some most closely resemble the tissues from which they have received their names, the likeness of others is faint and imperfect.

It has been already intimated that coagulating lymph performs a most conspicuous part in the reunion of divided parts. Without the assistance of this substance, no wound, however trifling, could possibly get well. The little incision made in the operation of venesection would either prove fatal, or become a source of permanent inconvenience and suffering. Ulcers would not heal, and fractured limbs would dangle about "in wild uncertainty." Formerly surgeons seemed to be entirely ignorant of the utility of this substance as a means of repairing injuries, whether occurring in the soft or hard parts of the body. It remained for Mr. Hunter to exhibit the subject in its true light, by which he created an epoch in the history of the science, amongst the most interesting that have occurred.

As admitting of the most easy examination, attention may be here directed to the part which this substance performs in the reparation of wounds of the cutaneous and cellular tissues. If these structures be simply incised, the edges of the cut surface, if kept in close apposition with each other, are united by what was formerly denominated *first intention*, or, since the time of John

\* General Anatomy, by Dr. Togno, p. 156.

Hunter, union by *adhesive inflammation*. In a case of this description, the first thing that nature does is to set up a new action in the part; that is, the wound becomes red, painful, hot, and tumid — phenomena which clearly indicate that her workmen are busily engaged in repairing the injury which has been sustained. Plastic lymph is now thrown out, by which the contiguous surfaces of the incision are gradually and effectually agglutinated together. Whilst this secretion is in operation, the vessels of the part are elongated, and, passing through the bond of union thus set up, they finally inosculate with each other, transmitting thereby the blood through the new substance, which, at the same time, increases considerably in firmness and density. Similar changes take place with respect to the nerves and absorbents. Thus the effused lymph becomes a living intermedium; and it is in this way that the restoration of divided parts, no matter what may be their structure, is effected. That the process, however, may go on kindly, it is essential that the concomitant inflammation shall not transcend certain limits; otherwise there will be suppuration instead of lymphization.

It is upon a knowledge of this property of coagulating lymph that are founded some of the most astonishing improvements that have been achieved by modern surgery. Amongst these the most remarkable are the operations for tying arteries, in cases of aneurism, so much perfected, if not devised, by John Hunter; and for repairing mutilated organs by transplanting parts from one region of the body to another. Much good has also resulted in respect to the treatment of incised wounds, whether produced by accident, by the removal of a tumor, or the amputation of a limb. In all these instances it is customary, in every part of the civilized world, with the exception, perhaps, of France, to endeavor, if possible, to bring about union by the first intention; the surgeon well knowing that if this can be effected he will save himself much trouble, and the patient no little suffering and inconvenience.

It has been a question, whether a part entirely separated from the body, will, if immediately replaced, again unite, and recover its vascular connection. Pieces of skin, of a finger, the nose, or the ear, have sometimes been successfully restored, and afterwards continued to live with their pristine vigor. Mr. Balfour, of Edinburgh, has published a number of interesting cases of this description, and every practical surgeon must have met with similar examples. Experiments upon the inferior animals also tend to show that a part, completely detached, may again adhere, and a perfect vascular communication be established. Du Hamel ingrafted the spurs of young cocks upon their combs, and found that perfect union took place in less than a month. The spurs, originally not larger than hemp seeds, attained, in the course of three or four years, the length of several inches, and adhered firmly to the head of the animal. Hunter repeated and varied these experiments; he transplanted the testis of a cock into the abdomen of a hen, and so perfectly did they unite that fine injecting matter was readily passed from the one to the other. A fresh human tooth, inserted into the same structure, speedily adhered, and became firmly fixed in its new situation. Dentists have repeatedly extracted teeth through mistake, and immediately replaced them into their sockets, where they remained and regained their vascular connection. The disgusting practice of transplanting teeth from the mouth of one person into that of another, so fashionable during the last century, is familiar to every one.

The effusion of lymph is a means employed by nature to obviate accidents. A convincing proof of this is witnessed in cases of tubercular phthisis. In this disease, abscesses generally form in the superior lobes of the lungs: these are sometimes seated quite superficially; at other times they are exceedingly capa-

cious, and extend in different directions until they make their way completely through the pulmonary tissue, and even the pleura. But does the softened tubercular matter usually escape into the cavity of the chest? By no means. Long before the event alluded to takes place, inflammation is set up in the surrounding serous membranes, followed by a copious secretion of lymph, by which an effectual barrier is opposed to the extravasation of the purulent fluid. Similar phenomena occur in ulcerations of the bowels, and in abscesses of the abdominal and pelvic viscera.

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## CHAPTER IV.

### OF SUPPURATION.

Definition. — Organs in which it is most easily effected. — May take place without Solution of Continuity. — Varieties of Form. — Abscesses. — Physical and Chemical properties of Pus. — Distinguishing Tests. — How produced.

A THIRD mode by which inflammation relieves itself is by suppuration. This consists in the formation of purulent matter, and constitutes, strictly speaking, merely the third stage of inflammation, inasmuch as pus is never deposited when there is an entire absence of this state. That this position is correct, no one at all acquainted with the subject will doubt. Hunter, it is true, is of opinion that collections of extraneous matter, as he terms them, may form in various parts of the body, without any antecedent inflammation; but in this notion he has not been followed, so far as I know, by any respectable authority since he promulgated it. Indeed, if any one will take the trouble to peruse the chapter which this great pathologist has published on this subject, he will be struck, at almost every line, with the vagueness of his expressions and the inconclusiveness of his reasonings. In what is called a cold abscess, the formation of which is sometimes the work of months, inflammation is just as much concerned as in a phlegmonous boil that is developed in two or three days. The only difference is, that, in the one the process goes on slowly, almost imperceptibly; while in the other it proceeds rapidly, and is accompanied with symptoms so well marked as not to be mistaken. But to discuss this topic at any length at the present day, when every thing relative to it is fully admitted, would be a matter of supererogation; and I shall, therefore, conclude this branch of the subject by laying down the proposition, that *the formation of pus, in whatever part of the body occurring, is invariably the result of inflammatory action, either acute or chronic, simple or specific.*

The formation of purulent matter does not take place with equal facility in all the organs and textures. Of the viscera, those which are most prone to take on suppurative action are the liver, lungs, and brain; of the tissues, the cellular, the cutaneous, mucous, and serous. In the fibrous textures, the cartilaginous, tendinous, and osseous, this fluid forms with difficulty, and is seldom of a thick, consistent nature. Of the mucous system some portions are more liable to be affected with suppuration than others. Thus, it is much more common to find pus in the colon than in the stomach or ileum, in the vagina than in the uterus, in the urethra than in the urinary bladder, in the nose than in the mouth, in the fauces than in the œsophagus, in the bronchiæ than in the larynx. So, likewise, in the serous system, suppuration is more frequent in some situations than in others; as, for example, in the pleura, the vaginal tunic



of the testicle, and the lining membrane of the larger joints. In the subcutaneous cellular texture, pus is most readily formed in those parts which are remote from the central organ of the circulation. The blood-vessels do not often suppurate, except when wounded; and the same, so far as we know, is the case with the absorbents. The lymphatic ganglions, however, are very frequently affected in this way, especially those of the axilla, the groin, the mesentery, and the base of the lower-jaw, in persons who are predisposed to scrofulous disease. The nervous tissue seldom suppurates, and still more rarely the muscular. From all these facts we may deduce the axiom, that those structures are most prone to form matter which contain the largest amount of loose cellular substance, and, conversely, that those which possess this tissue sparingly always suppurate with difficulty, requiring in general a much longer period, and elaborating a less perfect fluid.

It is well known that pus may be formed without any solution of continuity. This mode of suppuration, in fact, is very common, not only in all the serous cavities, but throughout nearly the whole of the mucous system. It is not, however, confined to these textures. In the cellular substance, in the lungs, brain, liver, and other viscera, nothing is more frequent than suppuration, without any breach whatever, in the first instance, of continuity.

Pus, when first effused, generally appears in the form of distinct globules, which are dispersed through the affected structure, and can be easily recognized by their pale yellowish color. As the purulent particles increase in number, they gradually become confluent by the absorption of the part concerned, and in this way the matter is at length collected into an abscess.

Abscesses are usually divided into three classes; the acute, the chronic, and the metastatic. This arrangement is founded on their mode of origin, and is of great pathological as well as practical interest.

The period required for the formation of an *acute* or *phlegmonous abscess* depends a good deal upon the constitution of the patient, the nature of the exciting cause, the degree of inflammatory action, and the anatomical elements of the part affected. In the lungs, brain, spinal cord, and spleen, death usually takes place before the matter has time to concentrate itself into a focus; and hence, in examining persons who have died of acute diseases of these organs, it is extremely rare to meet with an abscess even of small size. On an average, the period necessary for the formation of visceral collections of this kind may be stated at twelve or fifteen days; whereas in the subcutaneous cellular substance, abscesses often make their appearance in less than a week, sometimes, indeed, in less than forty-eight hours from the commencement of the inflammation.

When the abscess is superficial it always manifests a tendency to extend to the cutaneous surface, where it ultimately points and breaks. The period required to effect this depends very much upon the activity of the absorbent vessels, and the nature of the parts by which the fluid is covered. The process itself is denominated ulcerative absorption, and is always greatly promoted by the pressure of the confined matter. Its progress may be temporarily resisted by aponeurotic and other structures, but it ultimately surmounts every obstacle, though, perhaps, at the expense of much suffering. When the pus is long retained, it may commit extensive mischief by burrowing among neighboring parts, as is exemplified in whitlow, erysipelas, and abscess round the anus.

Visceral abscesses, on the other hand, usually discharge their contents into some hollow organ, or they burst into a splanchnic cavity. This is the ordinary tendency of purulent collections of the liver and spleen; sometimes, how-

ever, they pursue a more tedious and devious route, through the walls of the abdomen. Abscesses of the lungs usually open into a neighboring bronchial tube, from which the matter is afterwards expelled by coughing. In the kidney, the purulent fluid may escape along with the urine, or it may be retained, and ultimately find an outlet through the bowel, the external surface, or the peritoneal cavity. In the brain, as there is no vent for the pus, the abscess almost always proves fatal.

The purulent matter is sometimes enclosed by a layer of plastic lymph. This substance, which is poured out by the neighbouring vessels, and which presents itself in the form of a distinct sac, cyst, or bag, varies in its properties in different cases and even in different parts of the same preparation. In recent cases, it is always much softer than in those of long standing, owing to the new product not having had time to become thoroughly organized and converted into such a complete membranous pouch. In thickness it varies from the fourth of a line to a quarter of an inch, or upwards. Its consistence is often equal to that of a fibrous membrane, though generally it is much more easily torn. Externally it is rough, flocculent, and firmly united to the surrounding tissues, which are at the same time preternaturally dense and vascular, from inflammatory irritation. The inner surface of the sac is either smooth and glistening, or villous and granulated, of a pale ash, or reddish color, and constantly bathed by purulent fluid.

The manner in which this cyst is organized does not differ from that of the adventitious membranes generally. Its vessels are very numerous; and, although they are extremely minute, may be readily injected with fine size. The presence of absorbents is rather inferred from one of the functions of the sac than established by actual demonstration. That the contents of an abscess may be removed by the powers of the system, is well known to every surgeon; the process, indeed, often occurs spontaneously; at other times means are employed to excite and promote it. No nerves have been traced into it; nevertheless, it is perfectly certain that it is well supplied with them. Thus, we perceive that this pseudo-membrane is a highly organized structure, capable of performing important functions, and of awakening important sympathies in the system. It not only completely insulates the abscess from the surrounding parts, but it secretes, and often absorbs, the matter which it contains. Delpech, who has described it under the name of the *pyogenic membrane*, thought that its formation always preceded that of the pus, and that it thus became the immediate secreting tissue. This opinion, however, is only partially correct. After it is regularly organized, the pouch must necessarily secrete its own contents; but at an early period the matter is furnished by the vessels of the adjacent tissues, with which it is in immediate contact. We must, therefore, suppose that the membrane is formed subsequently to the abscess which it is destined to circumscribe.

When an acute abscess is formed with great rapidity, as when it is seated beneath the skin, the matter is either extensively diffused through the interstices of the cellular tissue; or it is circumscribed by a deposit of lymph, which is generally absorbed as soon as the fluid ceases to be secreted. It never presents itself, as in other cases, in the form of a distinct membranous pouch.

Acute abscesses offer much variety with respect to their volume. In general, their dimensions are in direct ratio to the spongy and vascular structure of the affected part. Thus, abscesses of the glandular organs, with the exception perhaps of the liver, are seldom so large as those of the groin, axilla, lumbar region, or the retro-peritoneal cellular substance, where they may attain a magnitude capable of holding several pints or even quarts. The number of acute abscesses is also liable to considerable variety. While in some cases

there is only one, in others, as in some of the deep-seated viscera, there may be as many as a dozen, twenty, forty, or even fifty. In small-pox, the number of little abscesses on the surface of the skin is often immense. Their contents are generally of a healthy or laudable character, and vary from a few drops to several ounces, pints, or even quarts; occasionally they are mingled with clotted blood, shreds of cellular tissue, or the debris of the organ in which the abscess is situated.

The formation of this variety of abscess is generally attended by well-marked symptoms. The pain loses its intensity, and changes to a throbbing or pulsatile sensation; the swelling becomes soft, but more prominent; the surface assumes a purple or livid aspect; fluctuation is perceived; the tumor points, the skin is attenuated, and the ulcerative absorption still continuing, an aperture takes place, which allows the contents to escape. Matter issues through the opening for some time afterwards; but the cavity of the abscess gradually contracts, and its sides are ultimately united either by granulation or direct adhesion. The same mode of cure is employed by nature when the matter is absorbed.

An abscess is said to be *chronic* or *cold* when the matter forms very slowly, and the morbid action which precedes it is so mild or inconsiderable as to escape recognition. There is usually no pain, heat, or redness of the affected part, and hence the disease often exists for months before it attracts attention. In its quantity, the matter varies from a few ounces to several pounds; it is generally of a whitish, yellowish, or greenish color, of a thin, whey-like consistence, free from odor, and intermixed with small caseous flakes, not unlike particles of soft-boiled rice. If it be allowed to stand for some time, it separates into two parts, one of which is serous, the other fibrinous, or, more properly speaking, tubercular. The fluid, in fact, is essentially scrofulous, and bears the greater resemblance to the pus of a pulmonary cavern. An abscess of this kind has always a distinct cyst, of a dense fibrous or fibro-cartilaginous texture, which is closely connected with the surrounding tissues, and is often several lines in thickness. Owing to this circumstance, the matter manifests little tendency to make its way to the surface; instead of this, it extends in different directions, forming frequently long and tortuous tracks before the superincumbent integuments are destroyed by ulcerative absorption. If the cyst be punctured, and its contents evacuated, the accumulation will be as great as ever in the course of five or six days. When the matter passes from one part to another it constitutes what is called a *congestive abscess*.

Chronic abscesses are most common in the subcutaneous cellular tissue, the lymphatic ganglions, and the dorso-lumbar portion of the spine. They are usually situated about the chest, in the neck, groin or axilla, the loins, or the circumference of the pelvis. There is seldom more than one, but occasionally two, or even three are observed in the same subject. They are generally of an irregular figure, and frequently present themselves at a distance of many inches from the original seat of their formation. Of this an example is furnished by psoas abscess, which always begins in disease of the spine, and often extends to Poupart's ligament or even beyond it.

This variety of abscess is almost always connected with a scrofulous state of the constitution; and, although there is generally an absence of the ordinary phenomena of inflammation, there can be no doubt that the influence of this process is essential to its production. The disease may last for several years before it finally disappears, or destroys life. As long as the abscess remains closed, the constitution does not seem to be disturbed by its presence; but no sooner is it opened than important sympathies are awakened, and the resultant irritation may be so violent as to prove fatal in a few days.



The *metastatic abscess* is most common in the internal viscera. It is rarely observed in the subcutaneous cellular tissue, in the muscles, or in the joints. The causes under the influence of which it is developed, are, injuries of the head, extensive wounds, compound dislocations, comminuted fractures, and capital operations. It also occurs during the puerperal state, and as a consequence of phlebitis, erysipelas, typhoid fever, pneumonia, and other diseases. Dance, who has carefully investigated this variety of abscess, finds that it most frequently affects the lungs and liver, then the spleen, and lastly, the brain, heart, and kidneys. It always selects the most vascular portions of these organs, and hence their periphery suffers much oftener than their centre.

In regard to their number, metastatic abscesses vary in different instances. It is seldom that we find only one; most generally there are as many as twenty, thirty, fifty, or even a hundred. Sometimes, indeed, the surface of the affected organ is completely studded with them. In a case mentioned by Dance, there were upwards of a thousand, principally in the deep-seated viscera. The size of this abscess is also very various. Some do not exceed that of a hemp-seed or garden pea; but others are as large as a hazelnut, a marble, a pigeon's egg, or an orange. When very numerous, they are usually proportionably small. In their figure they are generally oval, spherical, or angular; sometimes remarkably irregular. When seated near each other, they occasionally become confluent, like the pustules of small-pox.

The contents of a metastatic abscess are seldom of the nature of well-elaborated pus. On the contrary, they are almost always of a semi-concrete consistence, of a dirty greyish, cineritious, or drab color, and composed mainly of plastic lymph. This is particularly true of recent cases; in those of longer standing, the contents are more decidedly purulent, but even then they are often blended with grumous blood and flakes of fibrin.

The textures immediately around the abscess may be natural, or variously altered in their appearance and consistence. In most cases they are engorged with blood, heightened in color, softened, or converted into a pulpy diffuent substance. The coats of the vessels are inflamed, thickened, or infiltrated with serosity, and filled with pus, semi-fluid blood, or fibrinous concretions. The capillary veins usually participate in the inflammation.

The period which intervenes between the occurrence of the exciting cause and the actual development of the abscess varies from ten to fifteen days. The matter generally forms in a very rapid and stealthy manner, unaccompanied by pain, heat, or redness of the part which it selects for its seat. The most prominent symptoms are, violent rigors, usually paroxysmal in their character, delirium, stupor, prostration, and general insensibility. The development of this abscess has been variously explained. The ancients were of opinion that it was the product of metastasis; or, in other words, that the pus was absorbed from the part originally affected, and transported to some other situation, where it was collected into a focus. This view is entertained by many modern pathologists. Cruveilhier, Dance, and others, however, have conclusively proved, by a number of well-attested facts, that the abscess is the result of phlebitis, and that it often exists independently of the suppurative process in the organs and tissues which sustained the primary mischief.

The subject of abscess necessarily brings us to the consideration of the physical, microscopical, and chemical properties of *pus*. When genuine, or, as it is not improperly called, healthy, pus is of a pale yellowish tint, opaque, homogeneous, of a sweetish taste, without any particular smell, and of the consistence of thin cream. It is neither alkaline nor acid, and consequently does not affect vegetable colors until it has been for some time exposed to the air, when it

becomes slightly sour. It is heavier than water, in which it is partly dissolved, emits a faint, mawkish odor on being heated to the natural temperature of the body, resists putrefaction with remarkable pertinacity, and is coagulated by heat, alcohol, and muriate of ammonia. Pus freezes less rapidly than water, and when thawed it does not regain its original properties.

The specific gravity of pus is liable to considerable variation. It is less than that of blood, and greater than that of serum. Pearson, in one experiment, found it to be 1031, and in another 1033. According to Gueterbock, it ranges from 1030 to 1033. In seven distinct examinations of pus, taken from abscesses in different situations, — as the thigh, arm, axilla, back, pleura, and the lung in pulmonary phthisis, — Dr. John Davy found the specific gravity as low in one as 1021, and in another as high as 1042. This great disparity is mainly attributable to two circumstances, the unusual quantity of the solid ingredients, and the variable density of the liquid part.

Pus is composed of a prodigious number of small, opaque corpuscles, suspended in a thin, transparent liquor. These little bodies, which have received the name of pus-globules, are of a spherical form, rough on the surface, of a yellowish color, and from the  $\frac{1}{2000}$ th to the  $\frac{1}{3000}$ th of an inch in diameter, or about two-fifths larger than those of the blood. They are not all, however, of the same uniform size; some are smaller, and others larger, especially if they proceed from a highly inflamed surface. Fig. 10 exhibits these globules

Fig. 10.



magnified 800 times. By repeated washings with distilled water, they may be freed from the other ingredients; they contain very little inorganic matter, and they are soluble in concentrated acids, but insoluble in alkalis. On the addition of water they greatly increase in size, as is seen in Fig. 11, where the globules are magnified 800 times, and where the upper presents distinct nuclei.

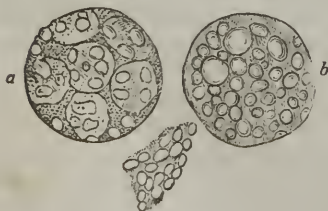
Fig. 11.



Each pus-globule consists of two or three central molecules, opaque, almost inconceivably minute, and enclosed by a transparent, homogeneous envelope, possessing all the properties of fibrin. Mr. Gulliver considers these nuclei as peculiar in their nature, and as essential to the composition of the pus-globule; in fact, as a distinct proximate animal principle. Mandl, on the other hand, regards them merely as small grains of solidified albumen, wholly unimportant in this respect. They are of a spherical figure, very dense, and easily set free by acetic acid, which

promptly dissolves their capsular covering. Fig. 12, copied from Gulliver, represents the pus-cells and their contents. On the right, near the margin, is

Fig. 12.



a congeries of molecules, or nucleoli, without any envelopes. A pus-cell, *a*, is seen to enclose the pus-globules, as nucleated nuclei. Another cell, *b*, invests an aggregation of molecules, or nucleoli. The pus-cells are about  $\frac{1}{1140}$ th of an inch in diameter, and are here magnified 800 times.

The chemical constitution of pus has been examined by a great number of experimentalists, from Grashius and Gaber to Donné, Dumas, Bonnet, Martius, Davy, Vogel, Gueterbock, and Bibra, who have furnished the latest and most accurate information. The

results of these investigations tend to show that pure pus contains all the proximate elements of the blood, except the colouring matter. The following analysis is by Gueterbock,\* from the pus of an abscess in the human breast.

Water	-	-	-	-	-	-	-	-	-	86.1
Fat, soluble only in boiling alcohol	-	-	-	-	-	-	-	-	-	1.6
Fat and ozmazome, soluble in cold alcohol	-	-	-	-	-	-	-	-	-	4.3
Albumen, pyine, pus-globules, and granules, soluble	-	-	-	-	-	-	-	-	-	-
neither in hot nor in cold alcohol	-	-	-	-	-	-	-	-	-	7.4
Loss	-	-	-	-	-	-	-	-	-	0.6
										<hr/> 100.

Gœbel† has published the subjoined quantitative analysis of pus from the uterus of a mare. The fluid was opaque, of a yellowish-white color, of the specific gravity of 1019, and of a faint, unpleasant odor.

Water	-	-	-	-	-	-	-	-	-	91.33
Albumen	-	-	-	-	-	-	-	-	-	7.20
Uncoagulable, gelatiniform animal matter	-	-	-	-	-	-	-	-	-	0.94
Free acids and salts	-	-	-	-	-	-	-	-	-	0.35

Dumas‡ analysed the pus of the frontal sinus of a mule, and found that 997 parts consisted of —

Water	-	-	-	-	-	-	-	-	-	820.0
Albumen	-	-	-	-	-	-	-	-	-	165.0
Animal matter, soluble in alcohol and water, phosphates and hydrochlorates, and free lactic acid	-	-	-	-	-	-	-	-	-	12.5

The substance of which the globules are composed has received the name of *pyine*; Gueterbock, who discovered it, considers it as a peculiar animal principle, but it seems to differ very little, if any, from fibrin. It is coagulable by heat, by acetic acid, and by a solution of alum.

Pus is liable to be modified in its properties by the presence of extraneous substances, such as grumous blood, fibrin, cholesterine, or the debris of the organs and textures in which it is formed. In common phlegmon, it often contains shreds of cellular tissue, of a dirty greyish color, not unlike wet tow. The brownish matter found in certain abscesses of the liver probably derives its color and consistence from the intermixture of the softened and broken down hepatic parenchyma. In suppuration of the different glands, the pus is not unfrequently mingled with the product of their secretion. Thus, in the kidney, it may blend itself with the urine, in the liver with the bile, in the mamma with the milk, in the testicle with the semen. Purulent matter is sometimes very fetid, from the extrication, probably, of sulphuretted hydrogen.

The different varieties of pus have received different names. When the fluid is of a whitish color, creamy in its consistence, and composed of a great number of globules, it is said to be *healthy*, or *laudable*, in reference to the

\* De Pure et Granulatione, p. 17. Berol: 1837.

† Gerber's Elements of General Anatomy, Trans. by Gulliver, p. 99.

‡ Repert. Gén. d'Anat. et de Physiol., t. iii. p. 47. 1827.



process by which it is produced, which is of a healthy, sanative, or restorative nature. It is usually met with in suppurating wounds, in healing ulcers, and in acute abscesses. Its properties have been already sufficiently described.

*Sunious*, serous, ichorous, or sanguinolent pus is thin, almost transparent, and of a yellowish, oily, or reddish color. It contains a superabundance of salts and hæmotosine, and is generally so acrid as to erode the parts with which it comes in contact. It is a product of unhealthy inflammation, and is principally observed in caries of the bones, in irritable ulcers, and in open cancers. This variety of pus is frequently blended with grumous blood, flakes of fibrin, and the debris of the affected tissues.

*Fibrinous pus* consists of common pus in combination with plastic lymph. It is of a whitish, greyish, or cineritious color, and of a semi-liquid, concrete, or lardaceous consistence. Under the microscope it displays the globules of healthy pus, with numerous other particles of irregular shape. It contains very little saline matter, and is commonly found in the joints, the splanchnic cavities, in metastatic abscesses, and in carbuncular inflammation. Its presence denotes a high degree of morbid action.

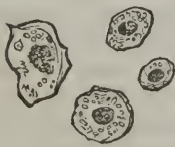
*Scrofulous pus* is mostly seen in pulmonary caverns, cold abscesses, scrofulous disease of the joints, and chronic inflammation of the lymphatic ganglions. It contains very little fatty matter, and usually separates into two parts, of which one is thick, straw-colored, and inodorous; the other thin, ropy, and mixed with small, opaque, curdy flakes. When scrofulous pus is long retained it may acquire a disagreeable, nauseous smell, not unlike the pollen of the chestnut; at other times it is excessively fœtid. The attendant action is usually very languid. Fig. 13 exhibits scrofulous pus from a chronic abscess. It is seen to be made up chiefly of minute spherules with granular matter, and the globules, which are destitute of nuclei, are fewer and less distinct than in healthy pus.\*

Fig. 13.



There is a variety of pus to which, owing to its admixture with mucus, the term *muco-purulent* is applied. It is usually a product of a high degree of inflammation of the various outlets of the body, particularly the nose, eye, bronchial tubes, and genito-urinary apparatus. The mucus which proceeds from these surfaces in the healthy state is composed of abraded epithelium cells, flat, and irregularly five-sided, with a central nucleus. In addition to these the microscope detects numerous granular masses, and a few spherical globules, very similar to those of pus; the whole being suspended in a viscid, transparent, ductile fluid. These different appearances are well depicted in Fig. 14. Under inflammation, the epithelium cells are cast off so quickly that they have not time to become flattened out, and the globules are not only greatly augmented in number, but they acquire the exact character of those of laudable pus. Thus mucus is converted into muco-purulent matter by an increase of albuminous exudation, and of the formation of spherical globules.†

Fig. 14.



Certain kinds of pus are *contagious*. Of this description is the matter of small-pox, varioloid, gonorrhœa, and chancre. In what particular element of the fluid the *virus*, or specific secretion, is contained, or whether it exists as an

\* Gulliver, op. cit., Pl. p. 62.

† Druitt's Surgery, p. 64. Philad. 1844.

entity, is undetermined. The vitality of the organ by which it is elaborated is not necessary for the preservation of its peculiar effects. Once secreted, it becomes independent of its source, and retains, for a considerable period, the power of contaminating the parts to which it is applied, producing a disease of the same character. Various chemical agents, however, as the alkalies and acids, have the property of neutralizing or destroying it, so that if inoculation be afterwards attempted, no effects will follow. If the pus of a chancre be examined by the microscope, it will be often found to contain animalcules, particularly the *vibrio lineola* of Müller. Wagner has seen the colpoda *cucullus* in the fluid of a cancerous lip; and the experiments of Donné, Vogel, and Gueterbock have proved that blennorrhagic pus may, under certain circumstances, possess alkaline or acid qualities.

Various attempts have been made to discover some test by which pus might be distinguished from other secretions, especially from mucus, which it is known to resemble more closely than any other. From some of his experiments, John Hunter was induced to recommend the muriate of ammonia, which readily coagulates pus, whilst no such effect is produced on blood or mucus. The younger Darwin proposed a double test of sulphuric acid and a solution of pure potash. If, on the addition of water to pus dissolved in either of these liquids separately, there is a copious precipitate, the matter made use of is judged to be purulent; but, if there be no such deposit, it must, as is alleged, be of some other character. Another test, more ingenious and philosophical, was proposed by Dr. Young, of England.\* It is founded on the globular particles of the fluid, and consists in putting a portion between two pieces of plate glass, holding it near the eye, and looking through it at a distant candle. If the matter be purulent, it will be encompassed by a bright halo of colors, not unlike those of the rainbow, the light being at the centre, and the tints so much the more intense as the particles are more numerous and more equably diffused. Gueterbock, who has recently examined this fluid with great care, finds the only distinction between it and mucus to be, that the pus-globules always sink in water, while the mucus floats. Finally, another method of deciding the difference is to dry the suspected liquid, when, if it be pus, the fatty matter may be readily extracted by ether.

Concerning the mode of production of this fluid, pathologists have expressed different views. Boerhaave and some of his followers attributed it to a dissolution of the solids; Pringle and Gaber, to putrefaction of the serum; Gorter and Quesnai, to changes induced in the coagulating lymph. But all these notions, with many others, have long been fully refuted, or deemed unworthy of this trouble. The first consistent theory on this subject was advanced by Dr. Morgan, of Philadelphia, in his inaugural dissertation published at Edinburgh in 1763. In this tract he threw out the hint that pus is a peculiar morbid secretion, which is always preceded and accompanied by inflammation of the affected part; and a somewhat similar view was shortly afterwards adopted by Mr. Hewson, of England. The way which was thus prepared by these and other pathologists, was subsequently more successfully explored by John Hunter, who placed the whole subject in so clear and conspicuous a light that very little has been added to it since the time in which he wrote. Pus is now universally regarded as the result of a peculiar secretion, not unlike that in kind, though more intense in degree, which is concerned in separating the nutritious particles from the vital fluid.

That pus itself is merely an altered state of the blood seems to be equally

\* Medical Literature, p. 574.

true, more especially when it is remembered that it includes all the essential elements of that fluid. How it is deprived of the coloring matter it is not easy to determine; it is one of those hidden and mysterious circumstances, concerning the efficient cause of which it would be absurd to speculate. If any reliance is to be placed in the well-conducted observations of Gendrin, it must be concluded that the formation of pus bears a very great analogy to the separation of serum and fibrin. On inspecting the capillaries of a frog's foot, which had been for some time in a state of inflammation, this distinguished pathologist repeatedly observed the changes which the globules of the blood undergo preparatory to their conversion into pus. At first, the minute vessels are merely dilated from excessive sanguineous engorgement; but, in the course of a day or two, the circulation becomes remarkably tardy, and they are then seen to be distended with a pale greyish fluid, inclining somewhat to yellow. In its character, this fluid is essentially globular, the particles of which it consists being considerably larger than those of healthy blood, and differing in their aspect according to the degree of the metamorphosis which they have experienced. Thus, at the centre of the inflamed part, they are of the color of cream, a little farther on, of a greyish appearance, whilst towards the periphery, where the elaboration is still very imperfect, they are partly red, and partly yellow, with various intermediate shades, more easily perceived than described.

A similar effect ensues, says Gendrin, in the coagulum which is formed consequent upon the tying of an artery. If a ligature be placed round the vessel above the obliteration, and a seton be passed through the clot, suppuration is observed in a short time to occur, the inspissated blood becoming gradually softened, and converted into purulent matter, in the same manner as in an inflamed tissue.\* These and other observations, which we have not room to dwell upon, conclusively show that pus is directly derived from the blood, by a peculiar process, which may be considered as a degree higher than that concerned in the separation of coagulating lymph.†

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## CHAPTER V.

### OF HEMORRHAGE.

The subject still involved in obscurity. — Causes. — Opinions of Morgagni and of Bichat; Exhalant Vessels. — Aptitude of different structures. — Nomenclature. — Predisposition. — Hereditary Proclivity. — Hemorrhage sometimes vicarious. — Active and passive. — Critical. — Quantity of Blood effused. — Changes and final Disposition.

In the pathology of hemorrhage there is much that remains to be elucidated. This is not surprising, when we consider the ignorance which still exists in relation to the capillaries in which this lesion is, for the most part, located. We have no means, except by analogy and induction, of ascertaining the habits, if I may so express myself, of these small tubes whilst engaged in the

\* *Histoire Anatomique des Inflammations*, t. ii. p. 471.

† "Il n'y a donc," says Gendrin; "entre le fluide purulent des tissus enflammés et le fluide coagulable organisable qu'un degré de plus." *Op. cit.* This remark is very similar to one made long before by Mr. John Hunter. His language is substantially this, — *that the new-formed matter peculiar to suppuration is a remove further from the nature of the blood than the matter formed by adhesive inflammation.* See his excellent chapter on Suppuration, in his work on the Blood.



discharge of their various functions. We are acquainted, however, with certain facts, and these, scanty as they are, must guide us in the discussion of the subject.

Although inflammation is not unfrequently attended by a discharge of blood, this is by no means the only condition in which this phenomenon is observed. In many instances it would seem to be the result purely of over distention of the capillaries, from obstruction in the heart or large vessels, by which the sanguine fluid is prevented from pursuing its accustomed route with its accustomed freedom. It is not necessary, however, in order to bring about this congestion, that the system should be in a state of plethora: most commonly, indeed, the reverse is the case, the quantity of blood being unusually small. In some diseases, again, such as scurvy and typhus, in which hemorrhagic effusions are by no means infrequent, it is exceedingly probable that the blood itself is morbidly affected, by which it is enabled the more readily to percolate through the relaxed parietes of the minute vessels, carrying with it its different component elements.

Formerly the idea prevailed that all sanguineous effusions invariably depended upon a rupture of the blood-vessels. Nor is this notion, even at the present day, fully eradicated from the minds of some physicians and pathologists. Morgagni seems to have been the first to throw out the hint that hemorrhages might be the result merely of a process of exhalation, without the slightest appreciable lesion of the vessels from which it emanates. This opinion, so well calculated to elucidate this interesting piece of pathology, was afterwards embraced by Bichat, who has fully discussed it in his great work on the tissues. He explains the phenomenon through the instrumentality of a set of open-mouthed vessels, known under the name of the *exhalants*. Of these he has described not less than three distinct orders, the excrementitious, nutrient, and recrementitious. The existence of such vessels was long ago admitted by Boerhaave and Haller; and, since their time, they have formed a favorite subject of speculation with many highly respectable anatomists. Unfortunately, however, much labor has been wasted which might have been turned to more profitable account; for it is now well known that there are no exhalants, in the true sense of that term; none, at all events, have ever been demonstrated, and probably never will be.

How, then, if the open-mouthed vessels, so minutely described by Bichat and others, have no existence, are we to explain the exhalation of blood? Are we to suppose, with Mascagni, that the arteries are every where furnished with pores through which the contained fluids merely percolate? That there are apertures in the tunics of the vessels, of some kind or other, is a circumstance concerning which there can no longer be any dispute. The experiments of Dutrochet, of France, repeated and modified by our countrymen, Dr. John K. Mitchell, of Philadelphia,\* and Dr. Edwin D. Faust, of South Carolina,† satisfactorily prove that all animal tissues are permeable to fluids and gases; which could not be the case if they were destitute of pores. What the nature of these openings is, it is not my design to inquire, nor is it material that it should be known. The fact that they exist is sufficient for my purpose.

Assuming, therefore, that all vascular canals are porous, the most plausible theory that suggests itself is that all hemorrhages, not dependent on rupture, are caused by a sort of endosmose, diapedesis, or transudation, by which the elements of the blood are forced through the coats of the vessels, and made to occupy situations in which they are not naturally found. The

\* On the Penetrativeness of Fluids. American Journal of the Med. Sciences, vol. vii., p. 36.

† Experiments and Observations on the Endosmose and Exosmose of Gases, ib. vol. vii., p. 23.

process, however, is not a mechanical, but a vital one, and consequently very different from the transudation of the blood which takes place after death from decomposition. How far this process differs from that of ordinary secretion, or what the precise conditions are on which it depends, are circumstances which it is not in our power to explain. Analogically, it may be inferred that the vessels are in a state of morbid activity, whereby fluids are suffered to escape that were appointed to be retained; or it may be supposed, as we have reason to believe is often actually the case, that the capillaries, being in a state of debility and relaxation, have their pores rendered unnaturally patulous, and thus allow the blood to have a more ready egress. Nor is it probable that the change, whatever it may be, is confined to the minute vessels. To give rise to the phenomenon in question, the nervous system must be involved, so as to promote, if not excite, the perverted action. The idea of Morgagni and Bichat, that hemorrhage proceeds from exhalation, embraces no error, further than that it ascribes this process to a set of vessels which, so far as is at present known, have no real existence. In all other respects, the term exhalation expresses the same thing as that of exosmose, transudation, oozing, or diapedesis.

The theory propounded by Morgagni and Bichat will not appear so difficult, if we take into account the results of some recent experiments in relation to the subject of venous absorption. The doctrine that this function is exclusively executed by the lymphatics, has been completely subverted by the researches of Magendie and other physiologists. If, then, it be admitted, as certainly it must, that the veins absorb or imbibe fluids, it does not require much stretch of the imagination to conceive that the arteries, which so much resemble them in structure, should exhale blood, especially when they are in a state of disease. This process, indeed, takes place, apparently, even within the limits of health, as in the uterus, where it constitutes the menses.

How far hemorrhage, not dependent upon rupture, is connected with inflammation, is a question for the solution of which we have no accurate data. That mere congestion will produce this result, has been sufficiently established by experiments on the inferior animals. Boerhaave excited hemorrhage in the intestinal mucous membrane of dogs by placing a ligature on the portal vein; and similar effects have since been produced by tying the vessels of the stomach, spleen, and other organs. Nevertheless, it is doubtful, even in these instances, whether the parts from which the blood flowed were not in a state approximating to, if not identical with, inflammation, as characterized in its earlier stages. As affording analogical evidence, we may here refer to the phenomena which take place in the uterus. After the period of puberty, it is the duty of this organ, at every lunar month, to elaborate a fluid, which, in every respect, resembles pure blood, save that it has a stronger odor, and does not coagulate. The discharge that is thus set up is a natural one, as it is common to all women; yet how comparatively few are there who do not experience more or less constitutional derangement during its existence? Many, indeed, undergo great suffering, laboring under all the symptoms which indicate the presence of inflammation. Taking into connection, therefore, these and similar facts, it is extremely difficult, I say, in many cases, to determine how far the exhalation of blood is concerned with, or independent of, inflammation. The relationship, so far as it goes, can only be ascertained by further observation and experiment.

Having made these remarks, it may now be stated that, so far as the *immediate* causes of hemorrhage are concerned, it may result, first, from exhalation; and, secondly, from direct injury of the vessels. In regard to the former of these divisions, enough has been said to render it unnecessary to add anything

more in this place ; as respects the latter, I shall only observe, that the most frequent source of hemorrhage is a rupture of the vessels, in consequence of disease of their tunics, or from the violence with which the blood is impelled into them by the action of the heart or by extraneous force.

The structures in which hemorrhage is most frequently observed are the mucous, the cellular, and the serous. Almost every organ and texture of the body, however, is liable to be thus affected. Of the mucous system, some portions are much oftener involved than others. It is asserted by some that all parts of the alimentary tube are equally subject to this effusion, which, however, is a mistake. Beyond all doubt hemorrhage is most common in the large bowel ; next, in point of frequency, in the stomach ; and, finally, in the inferior third of the ileum. The jejunum and duodenum, together with the œsophagus, mouth, and fauces, are rarely affected. A discharge of blood from the nose and bronchial tubes is not an infrequent event, while it is very unusual in the larynx and the trachea. In regard to the genito-urinary division of the mucous system, considerable difference obtains in the two sexes. In the male, the urethra and bladder are oftenest involved ; in the female, the uterus and vagina.

Of the serous membranes the parts most liable to sanguineous effusion are the pleura and pericardium. The cutaneous texture is very rarely affected, except in scurvy and typhus fever. With regard to the viscera, the brain and lungs are much oftener the seat of hemorrhage than any other. Indeed, it is doubtful whether some of them, owing to the peculiarity of their structure, are susceptible of this lesion. Be this as it may, effusions of blood, whether from rupture or otherwise, are exceedingly uncommon in the liver, spleen, kidney, pancreas, uterus, ovary, and testis. In the fibrous, cartilaginous, ligamentous, and osseous textures, they seldom, if ever, occur.

Eruptions of blood have received different names, according to the parts in which they occur ; but these it is not necessary to specify. They have sometimes been described under the term *apoplexy*. This word was originally restricted to hemorrhagic effusions of the brain : at the present period, however, it is employed in a wider sense, being applied to all extravasations of blood, no matter where occurring.

The predisposition to hemorrhage in different organs varies remarkably in the different periods of life. During childhood epistaxis is most common ; between twenty and thirty-five, there is an extraordinary proclivity to hemorrhage of the lungs and rectum ; about the age of forty, bleeding of the uterus is most usual ; from fifty to sixty, apoplexy and hematuria are most frequent, especially in men of irregular, dissolute habits. The exciting causes of hemorrhage are extremely numerous, but, as they do not particularly concern the pathological anatomist, they need not be enumerated in this place. A plethoric state of the system, especially in the young, and a nervo-sanguineous temperament, are circumstances which powerfully predispose to its occurrence. Climate also appears to determine some difference in the eruption of blood in different situations. In cold regions, for example, hemorrhage is most frequently observed in the nose, bronchial tubes, and urinary bladder ; in tropical, in the rectum and uterus. It is also said to be more common in the female than in the male ; but upon this subject we have no positive information.

One of the most remarkable circumstances in the history of this lesion, is its hereditary tendency. The facts which are in our possession, in relation to this subject, are too numerous and well authenticated to admit of the slightest doubt, in the mind even of the most skeptical. Almost every practitioner must have noticed cases of this description. Dr. Krimer, a German physio-



logist, records a curious instance in which this hereditary proclivity displayed itself in the male descendants of a family in four successive generations; and two similar cases have recently been reported by Dr. J. N. Hughes, of Kentucky.\* What is more singular than all, is, that the disease may cease in one generation and reappear in another. In a most remarkable case of this mode of transmission, mentioned by Dr. Riecken,† the parents, who both attained to old age, had never been subject to hemorrhage. The couple had twelve children — five boys and seven girls — of whom three of the former and one of the latter died of the lesion in question. The youngest daughter, who never suffered from the affection, married a stout, healthy man, by whom she had six children — four boys and two girls; two of the former of whom fell victims to hemorrhage.

Not less singular is that variety of hemorrhage to which the term *vicarious* has been applied. As its name imports, it is supplemental of a similar natural or morbid state in a remote organ, and is most frequently observed in young females, in consequence of the tardy appearance of the menstrual flux, or from its suppression after it has been established. In the great majority of cases, it is located in the mucous membrane of the nose, and recurs with considerable regularity every lunar month, until the obstruction, of which it is the result, has subsided. Occasionally the blood oozes from the skin, the eye, ear, lung, anus, and even the nipple, either simultaneously or successively. What particular changes, if any, the capillaries, which are the seat of these vicarious effusions, undergo, is not ascertained: we only know that they are the chief agents which are concerned in their production: beyond this all is doubt and uncertainty. That they are effected under the immediate influence of the functional operation of the minute vessels, as has been suggested by some, appears not improbable; but this, I apprehend, does not explain the matter, or bring us any nearer the truth than we were before.

Hemorrhages are usually divided into two classes, the active and the passive; the former occurring in strong, robust persons, the latter in such as are naturally feeble, or who have become so by disease, impoverished diet, or excessive evacuations. This distinction, however, is not of much value in a practical point of view, as it is often extremely difficult to refer the cases that are met with to the one or the other of these forms; nor is it of any importance in reference to the proximate causes of the disease, inasmuch as they are usually the same in both varieties. By others, again, hemorrhages have been divided into acute and chronic; an arrangement which is, perhaps, on the whole, the least objectionable of the two.

Hemorrhages are not always announced by precursory symptoms. In some cases the individual experiences obscure pains in different parts of the body, with a sensation of weight and fulness in the organ from which the effusion is about to occur, and chilliness of the extremities, particularly the feet. The blood, which often escapes with great rapidity, oozing out at innumerable points, is generally of a florid hue, and, although it readily coagulates, it seldom separates into serum and crassamentum, as when it is drawn from a vessel at the arm.

Sanguineous effusions sometimes occur as a *critical* discharge, especially in cases of protracted fever. Nature, in such cases, is said to make an effort to get rid of the original disease, by establishing an efflux in some remote part, which, in most instances, is the nose. Nevertheless, as the occurrence is not

\* Transylvania Journal of Medicine, vols. iv. and v.

† Edinburgh Medical and Surgical Journal, No. 108; also, Cyclop. Pract. Med., vol. ii., p. 480.

constant, it can be regarded in the light merely of an accidental circumstance, produced by some disruption in the balance of the circulation.

The *quantity* of blood varies in different cases, from a few drops to several quarts. Generally speaking, it will be likely to be much greater when it proceeds from the rupture of a vessel than when it is the result of exhalation. In no part of the body is hemorrhage so apt to be profuse as in the mucous system. In the uterus, the bronchial tubes, the stomach, and intestines, an immense quantity of blood is frequently discharged in the course of a few minutes.

When blood is effused, one of four circumstances happens in regard to its final disposal. In the first place, it may be entirely rejected. This is generally witnessed when the hemorrhage occurs in the œsophagus, the stomach, or bowels. In all these situations, as well as in the urinary, genital, and respiratory passages, the blood is voided either in a pure state, or blended with such substances as may happen to be lodged there at the time. Secondly, the fluid may be absorbed. This frequently takes place in the subcutaneous cellular tissue, and sometimes, also, in the brain, lungs, and other viscera. Thirdly, the blood may remain, and become organized; or, fourthly, it may act as a foreign substance, and induce fatal inflammation.

The above account would be imperfect were we to pass by the changes which are wrought in the effused blood. When it is poured into the pulmonary organs, it is usually quite fluid, and of a bright florid hue, from the influence of the atmosphere. In the stomach, on the contrary, it is generally more or less coagulated, and of a black color, from the action of the acid and gaseous contents of the organ. In most of the other viscera, properly so termed, it is of a dark complexion, and for the first day or two of a fluid consistence. Subsequently, by the action of the neighboring absorbents, the coloring and serous portions of the blood are in great measure removed, and the consequence is that it not only becomes lighter but likewise more dense and firm. At a still more remote period, the clot becomes organized, and not unfrequently also encysted. To these important changes, with which every physician should be acquainted, we shall revert when treating of cerebral apoplexy, a disease in which they are generally most conspicuous.

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## CHAPTER VI.

### OF SOFTENING.

One of the most unequivocal signs of inflammation. — Structures most liable to be affected by it. — In what anatomical element is the lesion seated? — Causes. — Opinions of Rostan and other writers. — Observations of Bennett. — Degrees of softening.

ONE of the most singular effects of inflammation is softening of the affected parts. This lesion was first pointed out by the late Baron Dupuytren, of Paris. The term which is here used to designate it is synonymous with that of mollescence or *ramollissement*, so much in vogue among the French pathologists. Next to redness, softening may be regarded as decidedly the most unequivocal sign of the existence of phlegmasial irritation.

Softening does not occur with equal frequency in all the organs and tissues of the body, yet there is perhaps not a single one that is not sometimes affected

with it. The parts in which it is most common, as well as most strongly marked, are the brain, the spinal cord, the mucous membrane of the alimentary tube, the spleen, and liver. It is occasionally seen in the tendons and cartilages, where it forms the principal, if indeed not the only, character of inflammation, both the redness and turgescence being, in most cases, entirely wanting here. The blood-vessels, the serous and fibrous textures, the ligaments, the voluntary and involuntary muscles, and the external teguments are among those parts of the body which are least liable to be affected with this disease, owing, no doubt, to the peculiarity of their nervous and vascular endowments. In the bones, softening is by no means uncommon, and may pervade nearly the entire skeleton. When this is the case, the other organs and textures of the body usually participate in the lesion, although so slightly, perhaps, as to be scarcely observable in making the dissection.

The interesting question here arises, — what is the particular anatomical element in which the lesion now under consideration resides? As might be expected, observations have been made with a view of deciding this point, and the result would seem to be, that, in nearly all cases, the structure most at fault is the interstitial cellular. In the liver, for example, the diminution of cohesion is never so strongly marked in the granulations as in the cellular substance by which they are surrounded. So likewise in the muscles, the fleshy fibres frequently retain their healthy consistence long after the connecting tissue is converted into a soft shreddy mass. In the stomach and bowels, also, the mucous membrane is never softened by inflammation without the cellular structure beneath participating in it. Indeed, it may well be doubted, when the lesion takes place in this situation, whether it be not always seated in the first instance in the submucous substance. This, however, is a point concerning which we have no positive data.

The most common cause of softening, as has been already stated, is inflammatory irritation, generally of an acute, but sometimes of a slow, chronic character. It may also be the result of causes which exert their influence after death. In making examinations, nothing is more common than to find the posterior parts of the lungs much softer than the anterior, simply, it would appear, from the stagnation of the blood; and, in the stomach, mollescence, it is well known, is frequently produced by the action of the gastric juice. These facts should be kept in mind by the pathologist; otherwise he will be in danger of confounding these phenomena with such as are caused by inflammation. There is a species of softening, particularly frequent in the brain and spinal cord, which is supposed by Rostan and others, to proceed from ossification, obliteration, or mechanical obstruction of the arteries. That mollescence may be brought about in this way is fully established; at the same time it must be confessed that it is far from being certain, that, when the nutrition of an organ is thus interrupted, the changes which it experiences are not of a character which assimilate it to inflammation. This opinion will not appear implausible when it is recollected that there is always more or less effusion of serosity, of lymph, or even of purulent matter. There can, indeed, strictly speaking, be no such thing as dry softening; and whenever, therefore, the fluids here referred to are found, there is reason to believe that they are poured out as an effect of inflammatory irritation.

The recent observations of Dr. Bennett,\* of Edinburgh, show that softening, at least as it occurs in the brain, is merely a modification of the ordinary process of suppuration. The affected tissues are first infiltrated with fibrin, which

\* Edinburgh Med. and Surg. Journ., Dec. 1842.



coagulates and forms minute granules, which adhere to the sides of the vessels, and fill up the intermolecular cavities. The effect of this deposit is to render the part perfectly dense or hepatized. Subsequently the granules are converted into nucleated cells, which after a time break down, and are disintegrated along with the tissues in which they are situated. If, at this stage, the part be examined with the microscope, it will be found to consist of granules, either diffused or amalgamated in masses, or contained in nucleated cells, and mixed with the debris of the softened organ.

The degree and consistence of a softened organ cannot be very well defined in a general way, and the consideration of it must, therefore, be postponed until we come to speak of mollescence of individual structures. In its color it may vary from a milky white, as in the brain, to deep red, as in the lung, with every intermediate shade of ash, brown, and yellowish. What is singular, the blood-vessels in many cases seem as if they had entirely disappeared, whilst in others they are so weak as to be incapable of withstanding the slightest pressure, or receive the finest injecting matter.

## CHAPTER VII.

### OF GANGRENE.

Definition. — Parts most apt to suffer. — Color and consistence. — Extent. — Manner in which Nature guards against the occurrence of Hemorrhage. — Causes of two kinds. — Malignant Pustule. — Gangrene from the use of Ergot. — From the exhibition of Tartar Emetic. — Senile Gangrene.

THE last termination of acute inflammation, of which we shall speak, is gangrene. In the United States and Great Britain the term gangrene is used to denote that condition of a part which immediately precedes its death. In France, however, a more considerable latitude has been given to its signification, the physicians of that country regarding it as synonymous with mortification and sphacelus. It is in this latter acceptance that the word will be employed in the present work.

Gangrene, mortification, or sphacelus, then, may be defined to be the extinction of the vitality of a part of the body, the rest of the organism retaining its life. When this event is about to take place, the affected structure loses its sensibility, it becomes cold, the blood ceases to circulate, and absorption is suspended.

The process by which these changes are accomplished is generally progressive, its rapidity varying with the constitution of the patient, the violence of the exciting causes, and, above all, the nature of the suffering structure. Thus, gangrene, in some cases, takes place in the course of a few hours, whilst, in others, it does not make its appearance for several weeks or even months from the commencement of the inflammation. Much diversity prevails amongst the different organs and tissues in regard to their liability to become affected with this lesion. The cellular, cutaneous, and mucous may be enumerated as the textures which are more frequently seized with mortification than any other; and it is worthy of remark that these are parts which are extremely well supplied with blood, especially the two latter. Nevertheless, in the skin and cellular substance, this event takes place most frequently in situations which are remote from the central organ of the circulation, as on the

hands, feet, and posterior portions of the trunk. In the mucous system, the parts most liable to mortification are the gums, the inside of the cheeks, the tonsils, the colon, the inferior third of the ileum, the urinary bladder, and the lining membrane of the vulva. The serous membranes, muscles, ligaments, tendons, aponeuroses, and cartilages are rarely affected in this way; and the same remark holds good in reference to the arteries, veins, and absorbents. The three latter of these structures, indeed, seem to possess a most astonishing conservative power, and hence it is not uncommon to find them retain their integrity in the midst of the sphacelated part. In malignant scarlet fever, attended with mortification of the tonsils and upper part of the neck, I have seen the common carotid go on in the performance of its function, and the individual recover, notwithstanding the detachment of immense sloughs of the skin and cellular substance; and similar phenomena have often been witnessed in gangrene of the inferior extremities.

It seems doubtful from the cases on record whether sphacelus has ever been actually observed in the uterus, kidneys, ovaries, supra-renal capsules, the thyroid body, the testicles, pancreas, and salivary glands. The occurrence, at any rate, is extremely rare, and further observations are necessary to settle the question. Gangrene of the lungs is by no means so uncommon as was formerly supposed by pathologists: in the liver and the spleen it is also sometimes observed, as also in the brain and spinal cord. The nerves are rarely affected; the heart, perhaps, never, although, as will be shown hereafter, several cases are on record in which the reverse seems to have been true. The bones are often destroyed by gangrene, especially those of the inferior extremities, from causes which often seem to be originally seated in their own structure, or in the fibrous membrane which surrounds them.

The color of the mortified part varies with the nature of the affected tissue. In the lungs it is frequently greenish, black in the spleen, cineritious in the cellular tissue, livid in the skin, brownish or pale yellow in the mucous membranes, and like the lees of red wine in the brain and spinal cord. This statement, of course, is liable to numerous exceptions, to which particular reference will be made in their appropriate places. Ligaments, tendons, and fibrous membranes rarely undergo much change of color, unless there is at the same time an abundant effusion of sero-sanguinolent fluid, in which case they occasionally have a reddish, macerated appearance.

It need scarcely be remarked that the consistence of a mortified part must depend, in great measure, upon the mode of aggregation of its anatomical elements, and upon the amount of blood by which they are nourished. In gangrene of the lung, which contains a large quantity of cellular substance, pervaded by myriads of the finest capillaries, the affected part is generally very soft — sometimes, in fact, a mere diffuent putrilage — in which it is impossible to discern the slightest trace of the primitive structure of the organ. Nearly similar phenomena are occasionally observed in gangrene of the brain, spleen, and liver. In mortification of the cellular tissue, especially in the carbuncular variety, the loss of cohesion is likewise very considerable; so that this substance can be torn and cut with much more facility than in the normal state. The harder solids, as they are denominated, on the contrary, undergo very little change of consistence, as is exemplified in tendon, ligament, and bone.

Much of this loss of cohesion is owing to chemical decomposition. The period at which this begins is greatly influenced by the structure of the affected part, the quantity of effused fluid, the season of the year, and the nature of the dressings. There are several species of gangrene, where, as will be presently seen, the affected part is perfectly dry, hard and shrivelled, approaching to the

condition of a rotten pear. In other cases the mortified mass is remarkably soft and boggy, exuding, on being divided, a large quantity of thin, turbid, sanious matter. It is on the absence of this fluid, on the one hand, and on its presence, on the other, that is founded the distinction, made by some writers, of dry and humid gangrene. The exhalation which arises during the progress of the decomposition, and which gives to gangrene its characteristic fœtor, has not, I believe, been thoroughly investigated by any chemist: probably it is of the nature of hydrogen gas, holding in solution a certain quantity of carbon, sulphur, and phosphorus.

The gangrene may effect a single tissue, or appear simultaneously in a considerable number. This latter occurrence is well exemplified in severe inflammation of the lower extremity: commencing in the subcutaneous cellular tissue, it gradually extends to the skin, the aponeurosis, muscles, periosteum, and bones, which, together with the vessels and nerves, it sometimes converts into one common splacelated mass, of a dark livid color. In a case of this description, should the patient's constitution be good, the gangrene, after having proceeded a certain distance up the limb, manifests a disposition to stop, or, more properly speaking, the surrounding structures make an effort to resist its further encroachment. This attempt is generally indicated by the appearance of a red line, for which the surgeon always anxiously looks, as it forms a circumvallation around the dead parts, and shows that the morbid action is arrested. The next step which nature takes in this enterprise is to set up ulcerative absorption, by which the mortified mass, now called a slough, is gradually detached, the structures that give way first being the cutaneous and cellular, then the muscular and fibrous, then the nervous and vascular, and, finally, the ligamentous and osseous. The absorption by which this important change is effected is confined exclusively to the living parts, and the rapidity with which it takes place is influenced by a great variety of causes, which it would be needless to enumerate.

One of the most interesting phenomena, in connection with this sloughing process, is the manner in which nature guards against the occurrence of hemorrhage. Long before death has accomplished its work, the blood in the vessels of the affected limb begins to coagulate, and, by the time the parts are ready to be detached, the inspissated fluid is firmly glued to the inner surface of the tubes by adhesive inflammation. The arteries and veins, however large, are thus, as it were, hermetically sealed, so that, on amputating the limb, particularly when the plug extends high up into the sound parts, there is frequently not the slightest hemorrhage.

The *causes* of gangrene may be divided into two great classes, into those, namely, which act directly upon the part, and into those which exert their deleterious influence through the constitution. Of the former, it is not necessary to say any thing in a work of this kind, further than that they are either of a mechanical, chemical, or physical character: of the latter, however, as they involve some highly interesting circumstances in relation to the operation of internal poisons, it will be proper to give a more comprehensive account.

Among the internal causes of gangrene, are organic diseases of the heart, leading to deficient circulation in remote parts of the body, imperfect supply of the nervous influence, habitual intemperance in eating and drinking, want of nutritious diet, and the inordinate use of spurred rye.

That an impoverished state of the blood, with lesion of the innervation, is a frequent cause of gangrene, is a fact which is now pretty generally admitted by medical men. In the lower orders of society, mortification from this source sometimes manifests itself in the mucous membrane of the mouth and vulva,



in the groin, axilla, and feet. The influence which a diseased state of the blood exercises in the production of this lesion is well exemplified in scurvy. Persons who labor under this affection are extremely prone to inflammation from the slightest accident, followed frequently by gangrene. The state of general debility, too, as has been remarked by Carswell, which prevails during protracted fevers, is well known not only to favor the development of inflammation, but to give this disease a peculiar tendency to end in mortification.

The malignant pustule, as it is termed, a disease which is not uncommon in certain provinces of France and Germany, and which will be noticed more particularly hereafter, seems to be often produced by causes which exert their influence through the medium of the circulating fluids. In the experiments of Hamont and Leuret, blood taken from the veins of an affected animal and transfused into those of a sound one, readily induced this singular malady. Even the flesh appears to be strongly impregnated with the septic agent, numerous examples being on record where death was occasioned by using it as food.

There is a singular species of gangrene which is very rare in this country, but sufficiently common in certain districts of France, Switzerland, and Germany, where it sometimes prevails endemically. Many of the inhabitants of these countries, it is well known, use rye almost exclusively as an article of food. In very moist seasons, this grain often contains a large quantity of blighted matter, which has received the name of *ergot*, *secale cornutum*, or cock-spur, and which, when employed for a considerable length of time, is supposed to give rise to the disease in question. The attention of the profession was first called to this affection by M. Dodard, a French physician, in 1676 : it was examined with considerable accuracy by M. Noel, surgeon to the Hotel Dieu, of Orleans, and, since his time, has been frequently made the subject of investigation ; but for the latest and most correct account of it we are indebted to M. Tessier.

This species of gangrene is, in every respect, a most singular affection. In the cases described by M. Noel, it always began in the toes, from whence it gradually extended along the foot and leg, until, in some instances, it reached the upper part of the thigh, or even the trunk. In the majority of the patients, the gangrene was preceded by redness, pain, and burning heat, which subsided, in the course of four or five days, leaving the parts cold, hard, dry, insensible, and black like charcoal. After some time, sloughing commenced, and, if the system was not too much exhausted, nature alone was frequently sufficient to effect the separation of the affected limbs. In one of the cases, both thighs were detached at the ilio-femoral articulation.

In a second series of cases, delineated by Gassoud, the disease is described as occurring in the feet and legs, together with the hands and arms. The symptoms which accompanied it varied in different individuals. In some, there was considerable swelling, with great pain and heat ; in others, the tumefaction was combined with redness, and the patient labored under fever and delirium ; in others, again, the suffering was entirely local, and was sometimes intermittent, sometimes constant. The separation of the black mortified mass commonly took place spontaneously, and was often attended with the most excruciating pain. Neither in these, nor in the cases mentioned by Noel, was there any of the fœtor which is so generally present in ordinary gangrene. M. Bossau, however, met with some instances of this affection in which the parts exhaled an insupportable stench ; but it is worthy of remark, that, in most of them, the gangrene was not of the dry kind. The disease, it would seem, attacked, indiscriminately, men, women, and children.

For a long time doubts were entertained whether ergot was really the cause

of this disease. With a view of settling this point, M. Tessier, an eminent French physician, was requested by the Royal Academy of Medicine of Paris to investigate the matter experimentally. The subjects of his researches were ducks, turkeys, and pigs. Without going into details, which would be foreign to my design, it may be briefly stated that these animals were strictly subjected to the use of spurred rye; that most of them died between the tenth and twenty-fourth day; and that distinct marks of sphacelus were perceived in different parts of the body, both externally and internally.

How, it may now be asked, does ergot operate so as to produce this singular effect? On this point we are still in complete ignorance. The only idea I can form of the influence of this substance is, that it exerts its deleterious impression, in the first instance, upon the blood, and, through it, upon the capillaries, causing inflammation in them, followed by gangrene. This opinion, indeed, seems to be fully borne out by the phenomena which precede this event, not only in the human subject, but likewise in the inferior animals. That the blood and its vessels are alone implicated, we do not assert: the nervous system, no doubt, is seriously involved: all that is contended for is, that these are the parts which receive the *primary* impression; and, in this view, we are, as just hinted, amply sustained by the facts of the case.

This affection is very rare in the inhabitants of this country. It has been several times noticed by our eastern practitioners; but I am not acquainted with a single instance that has occurred in the valley of the Mississippi; though such, no doubt, has been the case. In Chester county, Pennsylvania, it prevailed extensively among the horned cattle in 1819, and, in the following year, in Orange county, in the State of New York. In these instances the disease seems to have proceeded from the use of the *green grass*, the *poa viridis*, the seeds of which, as was ascertained by Dr. Mease, of Philadelphia, were affected with the ergot.\*

A very curious circumstance, in relation to the present subject, has been recently brought to light by some of the French pathologists. I allude to the fact that emetic substances, when taken in excess, will give rise, not unfrequently, to inflammation of the extremities, rapidly followed by gangrene. Several cases, illustrative of this effect, are recorded by Dr. Barbier,† of Paris, in his excellent work on the *materia medica*. One of them came within his own knowledge, in a woman, who, after having taken, a dose of drastic cathartic medicine, was seized with violent vomiting and purging, which, in a short time, produced the most alarming prostration of the vital energies. In this condition she was conveyed to the Hôtel Dieu. Next day the point of the nose, the ears, and cheeks assumed a deep purple color, and similar spots appeared on the feet and hands. All these parts were now rapidly attacked with gangrene, and one of the feet sloughed entirely off. In the other case, the particulars of which are detailed in the “Journal de Médecine” of Paris,‡ the patient, also a female, was attacked with severe cramp, spasm of the extremities, and extreme anguish. These symptoms were followed, in a short period, by lancing pains in the limbs, with dark blotches in different regions of the body. Gangrene appeared in the lower lip, the chin, the cartilaginous part of the nose, and in several of the toes, all of which successively dropped off. Are these effects produced in the same manner as when the system is laboring under the influence of ergot? To me, I must confess, the *modus operandi* of these substances is quite incomprehensible; yet the circumstance is certainly a

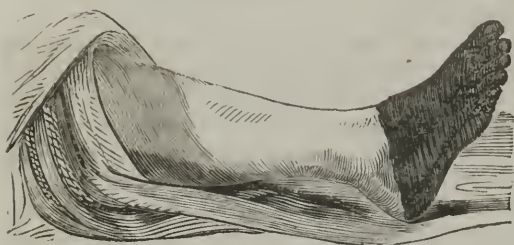
\* Domestic Encyclopedia, vol. ii., p. 52, and vol. iii. p. 196.

† T. iii., p. 327, quatrième édition, Paris, 1837.

‡ T. xxxviii.

curious one, and will no doubt receive further attention. The lesion may be said to be owing to the great and rapid reduction of the powers of life, giving rise to inflammation of the capillaries; but, if this be true, how happens it that all cases of general debility are not followed by gangrene? The parts are placed in the same relation as one deprived of its nervous supply.

Fig. 15.



Closely allied to the disease now described is that affection which was so well portrayed by the celebrated Pott, of England, under the name of mortification of the toes and feet. (Fig. 15.) As has been justly remarked by this great surgeon the lesion is most common in aged persons, though the young are by no means exempt from it. The subjoined table, compiled

by Dr. F. F. Hecker, of Stuttgart,\* exhibits the age in sixty-seven cases of this disease.

	1	between	1	and	10	years
6			10		20	
7		"	20	"	30	"
9		"	30	"	40	"
1		"	40	"	50	"
12		"	50	"	60	"
19		"	60	"	70	"
3		"	70	"	80	"
8		"	80	"	90	"
1		"	90	"	100	"

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The progress of senile gangrene is generally slow and insidious, commencing sometimes without the slightest pain, uneasiness, or swelling. The lower extremities, especially the feet and legs, are the parts of the body which are most frequently involved in this destructive process. The hands and arms may also suffer; it is but rarely that the nose, ears, lips, cheeks, and trunk are implicated. When the disease affects the lower limb, it generally makes its first appearance on the inside of one of the smaller toes by a circumscribed bluish spot, which is more or less painful, and is soon followed by a separation of the cuticle, leaving the skin beneath of a dark red color. In some instances the gangrene begins at a number of points at once, and when this is the case it is usually more rapid in its march, as well as accompanied with more urgent symptoms. In its progress, it gradually involves the whole foot, and not unfrequently the leg, and even the thigh, the soft parts of which are converted into a black, bluish, or brownish mass, often extremely offensive to the smell. The sloughing process generally goes on rapidly, and the bones occasionally drop off at the joints.

Mr. Pott, who observed this disease chiefly in gouty persons, states that it is much more common in men than in women, in the proportion nearly of twenty to one. In France, however, it seems to occur with equal frequency in both sexes, for the reason, probably, that their mode of living is more alike

\* British and Foreign Med. Review, vol. xiv., p. 86.



than in England.\* Of the sixty-nine cases examined by Hecker, twenty-seven were females, which gives a proportion of males considerably less than two to one. In this country, the disease is of very rare occurrence, some of our most experienced surgeons never having witnessed an example of it. In a practice of eighteen years I have seen only four cases of it. Of these, three were old females, one white, and two black. The other case occurred in a German priest, not more than thirty or thirty-two years of age. In three, the disease affected the toes; in the other, the heel and instep.

The cause of this variety of gangrene has been variously explained by different writers. Mr. Cowper, an old English author, threw out the idea that it might depend upon ossification of the arteries; a view which has since been embraced by other writers. This affection, however, is a mere coincidence, not the real and essential cause, which is undoubtedly inflammation of the lining membrane of the vessels, especially of the arteries, leading to an effusion of lymph, and the formation of coagula, fibrinous concretions, and other extraneous products in their interior. A mechanical obstruction is thus occasioned, which embarrasses, interrupts, or totally suspends the circulation of the affected part, and gives rise to the cold, dry, withered, and mummified condition which characterizes the disease. The obstruction, there is reason to believe, usually commences in the capillaries, from which it gradually extends to the larger vessels. How the inflammation which precedes and accompanies the obstruction originates, is not determined. The predisposing causes are various; but are referable mainly to organic disease of the heart and great vessels, vitiation of the fluids, particularly the blood, and impairment of the vital powers.

## CHAPTER VIII.

### OF ULCERATION.

Definition; intricate nature — Most common in the Skin, Cellular Tissue, and Mucous Membranes. — May be slow or rapid. — Manifests a tendency to extend towards the nearest surface. — Produced by Inflammation. — Influenced by an impoverished state of the blood. — Ulcers sometimes heal: the process by which this is accomplished. — Ulceration a sanative effort.

By this term I understand the solution of continuity of a texture from the absorption of its molecules. It is synonymous with what was anciently called erosion, and with what some modern pathologists, with Mr. Hunter, denominate ulcerative absorption. Of the intimate nature of this lesion nothing is known with any certainty, beyond the fact that it is usually connected with inflammation.

Although there are few parts which are not susceptible of ulceration, yet that this occurrence is much more frequent in some textures than in others, is a fact of which every one is convinced by daily observation. The cutaneous, mucous, and cellular tissues are infinitely more often affected than all the rest put together. This is well exemplified in the numerous blotches which sometimes cover almost the whole body, and in the erosions which are so frequently noticed in the bowels, mouth, throat, vagina, gall-bladder, and larynx. The heterologous formations, the bones and teeth, with the articular cartilages

\* Begin, Dict. de Médecine et de Chirurgie Pratiques, art. *Gangrene*.

and their coverings, come next in order. The serous membranes, properly so called, the fibrous and muscular structures, rarely suffer from ulceration; and the same is true of the internal viscera, excepting the uterus. Nature seems also to have endowed the vascular system with a remarkable power of resisting this process. Vessels, even of large size, are occasionally completely exposed from the destruction of the surrounding parts, and yet entirely escape the disease.

It is remarkable that parts even of the same structure will take on ulceration much more readily in some situations than in others. This is well exemplified in the digestive mucous membrane. Thus, for one erosion in the stomach, we find at least a thousand in the ileum and the colon; and so also, though not in the same ratio, with the skin of the upper as compared with that of the lower extremity. Newly-formed parts are extremely prone to ulceration. A cicatrice is rapidly destroyed by this process, because it is much more feebly organized than structures that have existed longer. The same thing happens in the callus of a fractured bone.

The ulceration occasionally proceeds with great rapidity, destroying as much of the body in a few days as nature can repair in as many months. It is sometimes limited to one texture; at other times invades a considerable number of them. In the bones, although it usually progresses very slowly, it is often remarkably destructive, whole pieces of the skeleton being, in some instances, literally eaten away. In the skin and mucous membranes it may persist for years, without greatly impairing the health of the individual. In the articular cartilages, although it may be equally protracted, it generally induces ankylosis, or death from constitutional irritation.

Ulceration always manifests a tendency to extend towards the nearest surface. This is a law which is attended with the most salutary effects; for, if there were no such provision, the individual, the subject of this process, would often fall a victim to its ravages. This tendency is well exemplified in the tibia. Ulceration commencing in the interior of this bone generally works its way through the part which is covered merely by the skin and periosteum, nature thus greatly economizing her time, and saving the surrounding structures from much mischief. Another beautiful illustration of this law is afforded by the liver. When an abscess is seated in this organ, inflammation is gradually set up in its peritonæal covering, followed by an effusion of lymph, by which the viscus is glued to the stomach, the colon, or duodenum. Ulcerative action now begins, and, in process of time, a communication is established between the adherent parts, affording a ready outlet for the purulent fluid. In this manner nature effects, in a few days, what, if the opening were made through the skin and muscles, it would require weeks to accomplish.

The great cause of ulceration is inflammation conjoined with pressure. In many instances, however, it follows suppuration and gangrene. Nor is pressure always essential to the process. In many situations, indeed, as in the cutaneous and mucous textures, ulceration occurs without the slightest aid from this source. On the other hand, there are examples in which pressure appears to be the principal agent, as in caries of the bones produced by the presence of a large aneurismal tumor. The same disease disproves the idea, formerly so current amongst pathologists, that ulceration can never happen without the formation of pus. Were any further illustration necessary of the fallacy of this opinion, we might refer to the mucous textures, where this process often occurs, unaccompanied by the slightest effusion of matter.

The question here comes up, what is the nature of this concomitant

inflammation? Is it of that description to which Mr. Hunter has applied the term adhesive? or does it possess a character altogether peculiar to itself? The latter supposition seems to me to be the most plausible, certainly most in accordance with what we know of the subject. Every practitioner is acquainted with the fact that an inflammation, apparently of the same kind and degree, produced by the same cause, and affecting the same tissue, will, at one time, end in ulceration, at another, pass off without any such occurrence. This can only be explained on the assumption that the inflammation which precedes and accompanies the ulcerative process is of a specific character, or, in other words, that it is modified by circumstances, either local or constitutional, or both conjoined, which the pathologist cannot appreciate. This opinion is the more plausible, as there are some erosions which invariably result from particular causes, and none other. The venereal ulcer has its peculiar features, not less than the tubercular, the herpetic, or the scirrhus? All these are specific affections, induced by specific agents, accompanied by specific inflammation, and followed by specific results.

An impoverished state of the blood powerfully predisposes to ulceration, and is supposed by some to be of itself sufficient, in many cases, to produce this result. In extreme anæmia, where there is always great deficiency of fibrin and albumen, sores are very liable to form in various parts, especially in those which are remote from the central organ of the circulation, from the slightest congestion of the capillary vessels, without any positive evidence of inflammatory disturbance. A blister applied to the calf of the leg, or even the trunk, will, under such circumstances, often speedily degenerate into a foul, sloughy, or irritable ulcer. In typhoid fever, similar sores frequently occur on the hips and buttocks; and in scurvy nothing is more common than ulceration of the mucous and cutaneous tissues. In both these diseases, the blood undergoes important alterations, which lead to disorder of the nutritive function and lesion of the innervation, followed by local congestions in remote and dependent parts of the body, where the circulation is naturally weak and languid. In all cases of protracted anæmia the muscles become thin and flabby, the solids are poorly nourished, hemorrhagic and serous effusions occur, wounds heal slowly and imperfectly, and old cicatrices often break out into open sores. This was strikingly exemplified in Lord Anson's voyage to the Pacific ocean, in which many of his crew suffered severely with the scurvy. It was remarked that those who had had sores before they embarked were attacked with ulceration in the same parts, and that if their bones had been formerly fractured they became disunited by the absorption of the callus. Ulceration of the cornea and other textures was found, by Magendie, to ensue in animals fed on sugar, starch, and other non-azotized articles of food, the protracted use of which greatly impoverished the blood, and thus brought the system under a condition similar to that which exists in scurvy, chlorosis, and typhoid fever.

The ulcerative process is usually accompanied with more or less pain. In the majority of cases, it is of a dull aching or gnawing character, as if insects were feeding on the part. Occasionally, it is entirely absent, or the patient experiences merely a slight degree of uneasiness. In some instances, it is continued; in others, intermittent; in others, periodical. With this symptom, there is often irritation, or hectic fever, with rapid emaciation, and great failure of the powers of the system.

The inflammation which precedes the ulceration always continues until this process is completely arrested. Andral supposes that it may entirely disappear, and still the erosion go on. This, however, seems to me to be a gratuitous assumption. We must unquestionably, I think, regard this disease



as essentially inflammatory in its nature ; and, although the part may be perfectly blanched, yet this does not prove that this process is not, to a certain extent, present.

Ulcers sometimes heal. This takes place much more readily in some tissues than in others ; but the process by which it is accomplished is the same in all, namely, by granulation. The different steps of this process, together with various other circumstances connected with ulceration, will be described in detail under the head of the different organs and tissues.

Ulceration may be regarded, in some degree, as a salutary process, or as a means employed by nature to rid the animal economy of extraneous materials. We have already seen that collections of purulent fluids have a disposition to escape by the nearest and easiest route ; and this is uniformly effected by the agency of ulceration. A ball lodged under the skin is removed in the same way ; or it travels from one region to another, and is finally cut out at a considerable distance from the place where it was originally situated. It is useful also in the expulsion of tubercular matter, in the exfoliation of the bones, and in the sloughing of the soft parts. In other cases, again, as in old drunkards, the process seems to be designed to relieve the system of hurtful fluids ; which it does by establishing extensive sores on the legs, attended with a perpetual flow of irritating matter. Thus we see that ulceration, although apparently a very unpleasant, is in many instances a most fortunate event, and one for which the practitioner often anxiously looks.

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## CHAPTER IX.

### OF GRANULATION.

Importance of the subject.—Nature of Granulations.—Difference in regard to their vascularity and sensibility.—How modified by texture.—Are secreting and absorbing organs.

LEAVING the subject of ulceration, I now come, by an easy transition, to speak of that of granulation. This process, like that of union by the first intention, is one of the grand operations employed by nature for the cure of wounds, and the filling up of ulcers. To the surgeon, a knowledge of this process is of indispensable importance ; whilst to the inquisitive physiologist it discloses a series of changes, which, in point of interest, are not surpassed by any in the animal frame, whether in a sound or diseased state.

A granulation is a small, vascular body, generally somewhat mammillated in shape, more or less red, sensitive, and capable of secreting pus. It consists, in the first instance, essentially of coagulating lymph ; and the process by which it is formed is very similar to that which is concerned in union by the first intention. Let me be understood. An individual receives a wound involving the skin and cellular tissue. The edges, instead of being brought into contact, are allowed to remain apart. Immediate adhesion being thus prevented, another process, more complex and tardy, is instituted. The sore now becomes painful, and, in short, exhibits all the ordinary phenomena of inflammation. A thin, watery fluid oozes from its surface ; and, after some hours, — generally from six to twenty-four, — it is found to be slightly incrustated with lymph, by which its interstices are filled up, and the whole is made to

assume a smooth, uniform appearance. The layer thus formed is of a whitish color, somewhat ropy in its consistence, homogeneous, and easily wiped away. If it be allowed to remain, in the course of a short time, varying from one to two days, sooner or later, according to the activity of the sore, the exudation becomes organized by the subjacent old vessels extending into it, or, if we adopt the opinion of some, by the formation of new ones, which inosculate with those of the divided parts. The surface of the sore is now of a red color, readily bleeds if it be touched, and is elevated into a great number of little rounded bodies, closely aggregated together, which are the rudimentary granulations. Another layer of plastic lymph is next effused, the vessels are still further elongated, and thus incrustation after incrustation is formed and organized, until the cavity is finally filled up.

Not only does each granulation receive one or more arterial and venous branches, but, in all probability, also a small nerve and an absorbent. Such, at least, must be our conclusion when we reflect that this little body not only bleeds when roughly handled, but that it often becomes highly sensitive, and that it readily absorbs such substances as are placed in contact with it.

The vascularity of these little bodies is much greater, I am disposed to think, than is usually imagined. That they are liberally supplied with vessels is at once indicated by their florid complexion, by the astonishing rapidity of their growth, by the facility with which they bleed when touched, and by the fact that they become hard and tumid if filled with injecting matter. The arteries, the precise number of which is not known, having entered the base of each elevation, soon separate into arborescent branches, which freely anastomose with each other, as well as with those in the granulations immediately around. Accompanying these arteries are corresponding veins, which carry away the blood which is not required for the nourishment of the part, the effusion of lymph, and the secretion of pus, with which the abraded surface is usually covered. Both classes of vessels are generally varicose, and much convoluted, as in Fig. 16, from Mr. Liston: *a*, represents the free surface of the injected

Fig. 16.



granulations; *b*, the attached surface. Whether the nerves and absorbents are of new formation, or merely elongations of those that previously existed, it is impossible to determine. The latter supposition is probably the true one.

Granulations are often very sensitive. This, however, is not the case every where, or under all circumstances. In the cutaneous and cellular tissues, the granulations are, all other things being equal, incomparably more sensitive than

in the tendons, aponeuroses, and ligaments. The same thing is true with respect to the granulations of the bones, except when they spring from the cancellated structure, in which case they are frequently so tender that it is impossible to touch them without inducing severe pain. These little bodies are also more sensitive when there is much inflammation, and in persons of an irritable and worn-out constitution than in such as are healthy and robust. In some instances, especially in old ulcers of the leg, they are more than triple the ordinary size, extremely pale, cold, apparently infiltrated with serosity, and so completely insensible that they may be cut without the least pain.

Granulations are absorbing as well as secreting bodies. These properties, however, are not equally well marked in all the tissues. A great difference, for instance, exists in this respect between the granulations which arise from the skin and those which arise from the bones, the former absorbing and secreting with great rapidity, while the latter perform these offices very slowly and imperfectly. A knowledge of this fact is of no little value in the practice of surgery, as it enables us, on the one hand, to avoid stimulating dressings, and, on the other, the application of such substances as have a tendency, when absorbed into the system, to give rise to dangerous results. Not a few cases are on record where arsenic, corrosive sublimate, and other articles of the *materia medica*, placed in contact with a granulating sore, have destroyed life. The extract of belladonna, used in this way, will produce temporary amaurosis, mercury will salivate, and opium, it is well known, will occasion sleep nearly as soon as when introduced into the stomach.

Thus, granulations are a very interesting and important set of textures, extremely complex in their structure, and performing the triple office of pouring out lymph, secreting pus, and absorbing such substances, to a greater or less extent, as are brought in contact with them. The facility with which they are developed is much greater in some tissues than in others, depending on the degree of laxity and vascularity of the part from which they spring. The concomitant inflammation appears also to be of a mixed character, as it is attended with the simultaneous effusion of lymph and purulent matter; and it is important that the phlogistic action should not transcend certain bounds, otherwise the process will be interrupted, retarded, or wholly suspended. The skin and cellular substance appear, of all the tissues, to be most susceptible of granulation. Mucous membranes, aponeuroses, ligaments, tendons, cartilages, and bones, together with the internal viscera, excepting, perhaps, the brain, rarely heal in this manner, and then only after a long time.

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## CHAPTER X.

### OF CICATRIZATION.

*Nature of the Process. — Different Steps. — Do Ulcers never heal from the Centre? — Process of Cicatrization influenced by the Form and Situation of the Sore. — Meaning of the term Cicatrice. — Reproduction of the original Tissues. — Transformations of Cicatrices.*

THE subject next in order is cicatrization. The remarks which I shall offer respecting it must necessarily be brief, as a great deal of what might be said will more appropriately fall under the head of the different organs and tissues.



Cicatrizization is the process which nature employs to heal wounds and ulcers. It is the finishing stroke, if the expression be allowable, of granulation, the labor necessary to polish the surface of the sore, to contract its diameter, and to bring it as nearly as possible to a level with the surrounding structures. This process, although it is not limited to the skin, as might be inferred from reading some modern treatises on surgery, is yet most advantageously studied there, as it enables us, as it were, to follow nature in the different steps of her enterprise.

The first step in the healing of an ulcer is the subsidence of the inflammation, which becomes gradually less and less, until the surrounding parts regain their natural color, form, and consistence. The sore at the same time sensibly diminishes in diameter, by the contraction and coalescence of its granulations; and its surface, instead of being rough and uneven, assumes a smooth, glassy appearance, its centre, however, being still considerably depressed; or, if the granulations have been very exuberant, unnaturally elevated. Cicatrizization is now observed to begin; the first indication of it being a thin, delicate, bluish pellicle, placed along the margin of the breach, where it soon unites with the old skin by an interchange of vessels, nerves, and absorbents. If the part be inspected at a later period, the substance that was thus deposited and organized, will be found to have increased in thickness and density, and to be gradually extending itself towards the centre of the ulcer by the addition of new matter. It is in this manner, by this successive experipheral action, that the denuded surface is eventually covered over.

But do ulcers and wounds never heal from the centre? This is a topic concerning which pathologists have expressed different sentiments, some maintaining the affirmative, others the negative side of the question. From an inspection of numerous cases, I am convinced that the process of cicatrizization takes place only in one way, namely, in that in which I have described it. To this remark there is only a single exception. In extensive wounds, especially of the lacerated kind, it often happens that portions of the original skin remain, forming so many little patches in the midst of the abraded surface. In such cases, the cicatrizization goes on simultaneously around these parts and along the principal edges of the solution of continuity. There is, however, no new law in operation here, since the old skin is the starting point of the new in both instances.

The process of cicatrizization is much influenced by the form and situation of the sore. Circular-shaped breaches of continuity heal much slower, *ceteris paribus*, than such as are longitudinal, for the obvious reason that it takes the new skin a much longer time to reach the centre in the former than in the latter. A sore in the leg cicatrizes with more difficulty than one on the trunk; and a callous ulcer than a soft one.

When the cure is completed, a *cicatrice* is left, or, as it is called in familiar language, a scar. This is always much smaller than the original sore, and still further diminishes by the contraction of the new skin. When the breach of continuity has been of great extent, as when it has been produced by a burn, this contraction is often a source of great mischief and deformity. At first, the cicatrice is extremely vascular, soft, and of a bluish color; afterwards the vessels decrease in size and number, and the part becomes dense, bloodless, and whiter than the original skin. This is well seen in persons who have had confluent small-pox, and in those who have been covered with venereal blotches. The vessels of the cicatrice are curiously interlaced, and anas-

Fig. 17.



tomose freely with each other, so as to form a very fine and delicate network, as in Fig. 17.

Are the original textures, in the formation of cicatrices, always regenerated? and, if so, in what respect, if any, do they differ from them? Cartilages and muscles are said to be the only parts not susceptible of reproduction. But even this is extremely doubtful; at any rate I am certain that I have seen muscles, which were almost entirely torn asunder, unite through the medium of fleshy matter. Very recently, I had under my charge a healthy lad, eleven years old, who had a large piece of the great pectoral and broad dorsal muscles torn away by a steam-engine, in which the breach of continuity was repaired by a substance perfectly identical with the original. The granulations were unusually florid, highly sensitive, and grew with astonishing rapidity. In old subjects, it is not improbable that the junction is sometimes effected by tendon. The cartilages of the ribs generally unite by osseous matter, certain pieces of the skeleton, such as the patella, the olecranon process, and the neck of the femur do by cartilaginous.

In most instances, however, the reproduction is imperfect. This is the case even with the skin. The cutis is never so strong or so capable of resisting the effects of disease as in the normal state; its inner surface is not reticulated, nor is it provided with sebaceous follicles. The mucous network is but imperfectly regenerated, and the epidermis drops constantly off in thin, dry, furfuraceous scales. No hairs are to be seen on the scar; for, as their roots have been destroyed, they cannot, of course, be reproduced. The same imperfect development is observed in the cicatrization of the mucous and some other tissues.

Cicatrices, like other analogous tissues, may undergo various changes. Of these the most frequent and important are, inflammation, inordinate contraction, hypertrophy, and semi-malignant degeneration.

All newly-formed parts are liable to inflammation, the effects of which they are much less capable of resisting than the primitive tissues, owing to the fact of their possessing a much lower grade of vitality. Hence, even when the morbid action is not very high, it may readily lead to softening, gangrene, or ulceration. In protracted anæmia; in short, in all diseases attended with an impoverished condition of the blood, cicatrices of the skin are extremely prone to suffer; their vessels become congested, their surface is discolored, and their tissues are invaded by ulceration or gangrene.

Inordinate contraction is most common in cicatrices produced by burns. These injuries are often followed by the most unsightly deformity, owing to the atrophy of the newly-formed tissues, and the property which they possess of diminishing their diameter. In this manner the chin may be drawn down upon the sternum, the hand bent upon the wrist, the arm pinioned to the side, the leg flexed upon the thigh. Even the bones may be curved, and forced from their natural position, so great is this contractile power.

A cicatrice may become hypertrophied, or grow into hard knobs or ridges. The best form of this occurs in burns, in consequence of some defect in the modelling process. The ridges have a rough, uneven surface, and a dense, fibrous structure; they creak under the knife, and the section exhibits a white, gristly appearance. The cuticle is thick and dry, and scarcely any cellular tissue exists in a free state.

Old scars, whether produced by a burn, cut, or laceration, or whether the skin alone is injured, or other structures along with it, become occasionally the seat of semi-malignant growths. Mr. Cæsar Hawkins,\* of London, was the

\* *Medico-Chir. Trans. of London*, vol. xix., p. 19.

first to describe this transformation under the name of the "warty tumor of cicatrices." The disease appears in the form of a little excrescence, which is dry and covered with cuticle, but which soon becomes moist, and partially ulcerated, secreting a thin, fetid, semi-purulent fluid. The excrescence is gradually converted into a more solid tumor, which may acquire the volume of a pullet's egg, and display all the characteristics of scirrhus or encephaloid. Ultimately ulceration sets in, fungous granulations spring up, and the patient dies from the irritation and discharge. The disease rarely returns if thoroughly extirpated.

## CHAPTER XI.

### OF INDURATION.

Definition. — Historical Notice. — Color, Size, and Degree. — Period necessary for its production. — Causes.

By this term I wish to designate that peculiar pathological condition of an organ which is characterized by an increase of its consistence, whether arising from the deposition of a new product, from a deficiency of the natural secretion, or simply from the transformation of its elementary tissues. This definition does not, of course, include the induration produced by the heterologous formations, such as tubercle, encephaloid, and scirrhus, with the latter of which the present disease is unfortunately too often confounded.

Until recently, induration, considered as a special lesion, does not seem to have attracted much attention. Andral has investigated it with his usual patience and ingenuity; and a few years ago Dr. Carswell published a very able article on it in the *British Cyclopædia of Practical Medicine*, a work which, from its rare excellence, should be in the hands of every intelligent physician. In the United States most of our knowledge in relation to the subject has been derived, from European sources, and, if I mistake not, the lesion in question has not yet found a place even in our best medical and surgical treatises. This, however, is not very surprising, when it is recollected that the same is true of hypertrophy, softening, and hydatids, with numerous other important and interesting topics, in respect to many of which we are still greatly behind the present state of the science, mortifying as it is to be obliged to make the confession.

Induration is an extremely common lesion, and may occur in any tissue of the body, but is most frequently seen in the spleen, liver, lymphatic ganglions, and subcutaneous cellular substance; next to which, the lungs, heart, brain, ovaries, breasts, and prostate gland are the most common seats of it. No age, sex, or condition of life is exempt from it; and, in France and Germany, it is often witnessed as an intra-uterine affection, or within a few days after birth. Like many other diseases induration may exist alone, or in association with other alterations; it may affect a part of an organ, its whole substance, or only one of its anatomical elements.

The *color* of the affected part usually partakes, to a greater or less extent, of the natural complexion of the organ. The most ordinary tints are red and grey, with numerous intermediate shades of white, yellow, brown, and black. As a general rule it may be stated, that the intensity of the color is in propor-



tion to the vascularity of the affected part, and the violence of the exciting cause. Thus, in acute pneumonitis, the induration — hepatization — is almost always characterized by deep redness, often verging on purple, whilst, in the chronic form of the disease, it is commonly of a dirty pale color, greyish, or dappled. When the induration occurs in structures that are naturally light, as in the subserous, submucous, and subcutaneous cellular tissue, there is always more or less concomitant opacity.

The *size* of a part in a state of induration may be natural, augmented, or diminished. An increase of bulk is by far the most frequent, and is sometimes very considerable in induration of the liver, spleen, and lymphatic ganglions. A diminution of size is by no means unusual, but cannot be regarded as a necessary consequence of the disease: the same remarks are applicable to the weight of the affected organ, which is much more frequently above than below the normal standard. There are other physical changes attendant on this pathological condition, which need only be alluded to in this place, such as diminished humidity, altered sonorousness, and loss of elasticity. These changes are strikingly exemplified in inflammation of the pulmonary tissue, which becomes dry, hard, incompressible, sinks in water, and emits a dull sound on percussion of the chest.

The *degree* of induration is liable to considerable variety, depending upon a number of contingent circumstances. Parts that are naturally soft and flaccid, are often, when thus affected, rendered quite dense, firm and unyielding. Of this the lung affords a remarkable illustration. In the sound state this viscus is soft, spongy, and elastic, but, when in a state of induration, it is sometimes almost incompressible, and cuts like old cheese, occasioning a peculiar grating sound under the knife. In induration of the heart, again, the walls of this organ are at times found so hard and unyielding as not to collapse when pressed, and to emit a sound, on being struck, similar to that of a horn.

Considered in a general point of view, induration may be said to present three degrees, which it is of some importance to distinguish. In the first, the part still retains its moisture, and feels only a little unnaturally dense; in the second, it is already firm, dryish, and considerably altered in color; in the third, its consistence is so much increased as to resemble the white of a hard-boiled egg, old cheese, or fibro-cartilage, every trace of its original softness, juiciness, and pliancy being gone.

As to the time requisite for the production of these several degrees of induration, no definite rule can be established, as it is influenced by a variety of circumstances, the consideration of which must be deferred until we come to speak of the special pathology of this affection. I shall, therefore, content myself, in this place, with observing that, in the great majority of instances, the process is remarkably slow; weeks, months, and even years elapsing before it reaches its full development. In other cases, on the contrary, it forms with great rapidity, a few days being sufficient for the alteration of a tissue from its normal consistence to that of a firm dense mass. Thus, if we consider the disease in reference to the period necessary for its development, it may be said at one time to be chronic, at another acute, the former being incomparably the more frequent.

This necessarily brings us to inquire, in the next place, into the *causes* of this pathological state. These are referable, for the most part, to inflammation, followed by an effusion of coagulating lymph into the interstitial substance of the affected organ. In the lungs there is frequently, in addition to this, more or less blood poured out, which, combining with the natural structures, gives them a red color. It is thus that red hepatization is established. In chronic cases, on the other hand, the induration is commonly effected by the lymph

alone ; and hence it is that the organ is usually of a much lighter hue. In the hardening of the subcutaneous cellular tissue of infants, a disease of pretty frequent occurrence in certain districts of Europe, the effused matter is generally impregnated with two coloring principles, the one of an orange red, the other of a bluish shade, both of which are stated by M. Chevreul to exist in the blood.

From the foregoing considerations, it is certain that one variety, at least, of induration is dependent upon inflammatory irritation. In a second series of cases, the lesion, if such it may be called, appears to arise from a deficiency merely of the natural secretion. To this category belongs the induration of the various organs and tissues observable in old people. As we advance in life, the whole body experiences an astonishing change in its consistence ; many of the vessels are obliterated, the juices are dried up, the solids are rendered hard and rigid, and, as a consequence, the movements are difficult and imperfect. An increase of consistence from this cause is generally most considerable in the cellular tissue, the *mammæ*, ovaries, prostate gland, the muscles of voluntary life, and the bones, the latter of which sometimes acquire a degree of hardness equal to that of ivory. The proximate cause of this condition probably consists in a diminution of the vascularity of the affected part, attended with a deficiency of the normal secretion, and perhaps, also, a partial absorption of its more tender anatomical constituents. The part thus becomes hard, dry, and, where the circumstances are favorable, shrivelled and corrugated.

In a third series of cases the induration is traceable to a real transformation ; that is, some of its anatomical elements disappear, leaving nothing but the original framework of the affected part. Examples of this description are occasionally seen in the liver, spleen, and lungs, around hydatids, serous cysts, tubercles, and other tumors. The irritation caused by the presence of these adventitious growths produces a partial absorption of the natural structures, leaving those which remain in a dense and indurated state. Similar effects are sometimes brought about by protracted compression, whether occasioned by bands of false membrane, or by large accumulations of fluid. Of this a striking illustration is furnished by the lung. In chronic pleuritis, attended with copious effusion, this organ is often reduced to the size of a small cake, by the approximation simply of its solid textures, which are thus rendered unnaturally dense and hard. If the compression is not kept up too long, these textures may be made, in time, to resume their natural bulk, form, and consistence ; and so the respiratory function be gradually restored. This variety of induration is almost constantly associated with atrophy.

Such are the several forms of induration which are noticed in the different organs and tissues of the body, and the causes under the influence of which they are produced. Let us next proceed to inquire, whether parts thus affected can regain their natural consistence, and, if so, under what circumstances ?

The former of these queries can be easily answered ; the latter properly belongs to therapeutics, and need not, therefore, be particularly discussed on the present occasion. That induration is susceptible of being cured, daily observation abundantly testifies. This remark is especially true in relation to the chronic form of the lesion : in the acute it is not so common, the disease usually reaching a fatal height before the system can properly react ; yet even here recovery is far from being infrequent. As the induration of which I am now speaking is caused by the deposition of a new product, it is obvious that whatever has a tendency to remove this, must be instrumental in bringing about the restoration of the affected part. It is with a view of accomplishing this object that the practitioner resorts to the exhibition of iodine and other kin-

dred articles, when the disease is located in some internal organ; or that he uses friction and other stimulating means, if it be seated externally. In either case he is desirous of producing the same effect, namely, the absorption of the effused substance, the incorporation of which with the natural textures gives rise to the lesion under notice. The time required for effecting this object cannot be specified, as it must be influenced by a great variety of circumstances which it would be out of place here to consider. In acute cases, the induration frequently subsides in the course of a few weeks, even when it involves a very large extent of surface and a multiplicity of tissues; in chronic ones, on the contrary, the process is usually very tardy, months elapsing before it is completed. In the mean time, the function of the part is imperfectly executed, and the longer the case is protracted the greater will be the danger that the organ will never recover its original consistence. Under such circumstances the affected textures frequently undergo the cartilaginous, fibro-cartilaginous, and osseous transformations; and, it is even thought by some, that they are apt to degenerate into malignant disease. This, however, is doubtful; at all events, I have never seen a case in confirmation of it.

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## CHAPTER XII.

### OF HYPERTROPHY.

Meaning of the term. — Liability of different Structures. — Causes. — May be general or local. — Color, Weight, and Volume of the Part affected.

THE word hypertrophy is derived from the Greek υπερτροφία, and literally denotes an excess of nutrition. Introduced into our anatomical nomenclature scarcely thirty years ago, it was originally restricted to those preternatural enlargements which are so frequently found in the heart and thyroid gland. As understood at the present day, however, it has a much more extensive application, being employed to designate an important class of lesions, the essential character of which consists in an abnormal development of the weight and volume of the various organs of the body, without, in most instances, any accompanying alteration of their organization and structure.

With the exception of the serous membranes, the ligaments, tendons, and fibrous envelopes, there is not a single organ which is not occasionally found in a state of hypertrophy. Nevertheless, there are some structures in which it occurs more frequently than in others, and amongst these may be particularly specified the heart, adipous tissue, spleen, thyroid gland, lymphatic ganglions, breast, bones, and blood-vessels. Hypertrophy is seldom seen in the brain, spinal cord, and nerves. It rarely commences in people below middle age, and from forty to fifty may be mentioned as its favorite time of invasion; but it is often observed in persons much younger than this, as those who are not more than five, ten, or fifteen. Indeed, it would seem occasionally, as is the case of the thymus gland, to come on soon after birth, if not before.

As to the *causes* which are concerned in the production of hypertrophy, some are of a general, others of a local character. Of the former, very little can be said to be known with any degree of certainty, as the affection in question sometimes occurs in spite of the most abstemious course of living. In



polysarcy, the body has been known to attain the enormous weight of upwards of seven hundred pounds, without the individual being at all remarkable as a large eater. In such cases, — which depend chiefly upon an inordinate development of fatty matter, — there would seem to be a peculiar diathesis, — almost every thing that the person consumes being converted into adipous substance. Not less notable is the hypertrophy which occasionally takes place in the bones, liver, spleen, and the lymphatic ganglions of scrofulous children.

Of general hypertrophy a most extraordinary example is recorded in the first volume of a French periodical, entitled "*The Hebdomadary Journal of Medicine.*" The individual was a girl, twenty-nine years of age; during the last eleven of which she had suppression of the menses, embarrassed respiration, numbness of the limbs, and frequent attacks of headache, with progressive development of the cutaneous, adipous, cellular, and muscular tissues. At the period here specified, the face was enormously enlarged, the tongue almost filled the mouth, the neck was extremely thick, and the breast reached nearly to the chin. The circumference of the trunk was five feet two inches, just equal to the height of the body, and the extremities, both upper and lower, were of prodigious size. This extraordinary bulk was not caused by the excessive accumulation of the subcutaneous fat alone, as all the external muscles appeared prominent and well-defined. The heart was hypertrophied in the same proportion, and struck with unusual violence against the side of the chest. The brain likewise participated in the abnormal growth, and the girl finally became idiotic. In this case the symptoms above referred to are obviously insufficient to account for the origin of the excess of nutrition, and we must therefore suppose that the individual labored under some constitutional peculiarity.

Local hypertrophy may occupy an entire organ, or, as more frequently happens, be confined to particular sections of it; it may exist either alone, or in connection with other lesions.

The local causes which manifests their effects in the production of hypertrophy are, first, chronic inflammation; secondly, mechanical obstruction; thirdly, inordinate exercise. Each of these topics we shall endeavor briefly to illustrate.

That chronic irritation may produce hypertrophy, is a fact of which every pathologist must have witnessed frequent examples. Who has not seen the lymphatic ganglions of the groin preternaturally enlarged from irritation of the head of the penis, of the mesentery from ulceration of the ileum, and of the bronchiæ from disease of the lungs? Enlargement of the liver and spleen, sometimes to a very great extent, arises undoubtedly from this cause. In chronic dysentery, not only the mucous and submucous cellular textures become hypertrophied, but the affection often extends to the muscular tunic, which occasionally attains an extraordinary degree of development. The follicles and villosities, which are hardly perceptible to the naked eye in the healthy state, are also rendered extremely prominent, the former being sometimes of the size of a mustard-seed, the latter more than a line in length. A similar development is frequently observed in the coats of the urinary bladder, in consequence of chronic inflammation.

Hypertrophy may be caused, secondly, by some mechanical impediment interfering with the due performance of the functions of an organ. This is frequently seen in the heart, where, in consequence of the existence of disease of the valves, preventing the easy passage of the blood, the viscus is obliged to undergo increased action, and so becomes more or less enlarged. In the muscular fibres of the stomach, the same change is often witnessed from

obstruction at the pylorus, and in those of the urinary bladder, from stricture of the urethra, or enlargement of the prostate gland.

Hypertrophy may, in the third place, occur solely from the increased action of an organ in the discharge of its normal functions. Of this variety examples are found in the muscular system of animal life, in the lungs, and in the kidneys. In every part of the frame, the muscles are proportionate, in size and structure, to the efforts required from them; and it is a law of nature that, whenever they are frequently called into action, their fibres become considerably augmented in thickness, and capable, consequently, of much greater exertion. Thus the blacksmith, who constantly uses his arms in striking with his hammer, has much larger and stronger muscles than the dancing-master, who merely employs his legs. So also with the lungs and kidneys. When one of these organs is imperfectly developed, compressed by effused fluid or some morbid growth, or, as in the case of the latter, entirely absent, the other is sure to become preternaturally expanded, and thereby compensate for the deficiency. There are some viscera which are subject to temporary hypertrophy. Of this description are the uterus and mammary gland. During pregnancy and lactation these organs increase very much in bulk, but again diminish soon after parturition and weaning.

The color of a hypertrophied organ is subject to considerable diversity. Most generally, perhaps, it is somewhat heightened; especially when the affection is wholly physiological. Occasionally it is very much diminished; and cases are often observed where it is apparently quite natural. The consistence may likewise be normal, diminished, or increased. These three conditions do not, however, occur with equal frequency. An increase of density is by far the most common, and is particularly conspicuous in hypertrophy of the heart, mammary gland, the muscular fibres of the stomach and colon, the lymphatic ganglions, cellular tissue, bones, liver, spleen, and kidneys. A diminution of consistence is extremely rare, and cannot be viewed as a necessary consequence of the lesion.

An increase of weight of the affected organ follows as a matter of course in all cases where the lesion is not conjoined with atrophy. An augmentation of volume is by no means constant. Thus, in hypertrophy of the heart and bladder, there may be great development of the muscular fibres, with marked diminution of the size of their cavities. A change of form always arises when the hypertrophy is partially circumscribed, or limited to a particular point, as in the bones, skin, heart, bronchial tubes, and blood-vessels.

Hypertrophy essentially consists in an augmentation of the nutritive function. When in a state of unusual activity, the quantity of blood which an organ receives is considerably increased, in consequence of which it assumes a deeper color than one that is less used, at the same time that it augments somewhat in density. The reason of this will be evident, when it is recollected that the arteries which are sent to the hypertrophied viscus are abnormally large, and therefore capable of depositing a much greater amount of nutritive matter. The elementary particles are probably not increased in number, but such as already exist are augmented in size: it is in this manner that the change under consideration is brought about. In that variety of it which results from chronic irritation, it is not unlikely that there is often superadded to the alteration just mentioned a deposit of new substance in the cavities of the connecting cellular tissue, leading thus to a real change of structure. The effects of hypertrophy on surrounding parts, and the symptoms by which it is characterized, will be pointed out when we come to speak of this lesion as it occurs in different organs of the body.

## CHAPTER XIII.

## OF ATROPHY.

Definition.—May be General or Partial.—Causes: want of Exercise; Diminution of the Nervous Influence; Deficient supply of Blood; Inflammation.

DIRECTLY the reverse of the lesion now described is atrophy, an affection which, from the frequency of its occurrence, and from the great attention which it has received of late years from the pathologist, is a subject of too much interest to be passed over without some consideration in this place. Like hypertrophy, with which it often coexists, it may pervade the entire organism, or be limited to a single viscus, or even to one of its elementary constituents; and as the one essentially consists in an increase of the nutritive function, with a corresponding augmentation of bulk, so the other must be regarded as depending on imperfect exercise of the same function, with a corresponding diminution of the affected part.

General atrophy, commonly called marasmus, emaciation, or consumption, frequently arises from organic disease of the lungs, heart, and stomach, and from morbid enlargement of the mesenteric ganglions, preventing the passage of the chyle from the intestinal tube into the thoracic duct. Occasionally, however, this lesion of the nutritive function exists in a very high degree without any ostensible cause. Who does not recollect the extraordinary individual who was exhibited in New York, a few years ago, with the soubriquet of the "living skeleton?" Calvin Edson, for such was his name, weighed only fifty-eight pounds. He was forty-two years old, five feet two inches high, and formerly weighed one hundred and thirty-five pounds. During the last sixteen years of his life he had been gradually wasting, without any apparent disease, his appetite and health being as good as usual. In another instance of extreme atrophy of the general system, in a young Frenchman named Seurat, who was shown in London, not long ago, the lesion seems to have been connected with imperfect alimentation, as the individual did not, on an average in the twenty-four hours, take more than three or four ounces of food, with a little wine.

All animals have a period of growth, maturation, and decay. In the human subject, the body, after having reached the age of forty, begins to exhibit traces of decline, which from this time on become gradually more and more conspicuous, until the machine is literally worn out, and man "goeth to his long home." Examined at this period, the whole mass of the brain is generally found diminished in size, the nerves have lost their moisture, and the ganglia connected with them are condensed, and considerably shrunk in volume. The respiratory system experiences similar changes: the lungs are dryish, inelastic, and increpitous, their volume is sensibly lessened, the walls of the air-cells are attenuated, and whole lobules are sometimes deprived of their vesicular structure. The muscles of voluntary life are pale, flabby, and diminished in bulk; the arteries, veins, and absorbents shrink in their diameter, and a large proportion of the more minute ones, becoming useless, are obliterated, and lost; the lymphatic ganglions are hard, small, and many of them entirely disappear; the bones are spongy, brittle, and extremely prone to fracture; the ligaments are unusually slender; the articular cartilages dry, and attenuated; and the salivary glands, together with the liver, pancreas, spleen,



and kidneys, are indurated, and considerably reduced in size. In the male sex, after the functions of the testicles have ceased, absorption frequently commences in these bodies, which shrink, become soft, pulpy, and are sometimes not larger than a French bean. The cells of the penis are augmented, and their fibrous parietes very much attenuated, in some instances even partially absorbed. In the female, the ovaries are pale, shrivelled, and frequently transformed into a condensed greyish substance; the mammæ are soft and flabby, with scarcely a trace of their original structure; and the uterus is hard, firm, and diminished in volume.

Along with the changes of texture here described, are to be observed certain alterations in the various fluids. The digestive function being less vigorously executed than in youth and manhood, there is a less perfect elaboration of the chyle, followed by a deteriorated state of the blood which is prepared from it. Nor does the difficulty end here. On reaching the lungs, the vital fluid, in consequence of the deranged state of the pulmonary tissues, is but partially acted on by the atmosphere, and is thus rendered unfit for the proper nourishment and stimulation of the various organs and textures of the body. The jelly, which exists in such great abundance in young persons, totally disappears in decrepitude, its place being usurped by albumen and fibrin. The various secretions are likewise modified, and every thing indicates that the blood has undergone important changes, both in its physical, chemical, and vital properties. Such is a rapid sketch of *senile* atrophy, a state which strongly illustrates the effects of the wear and tear of the animal machine.

Local atrophy may effect an entire organ, a portion of an organ, or one or more of its anatomical elements, exist as the only lesion, or be associated with other diseases. The causes which give rise to this affection are, first, cessation of the function of an organ; secondly, diminution of the nervous influence; thirdly, deficient supply of blood; and fourthly, inflammatory irritation.

It appears to be a law of the animal economy, that, when an organ is of no further use, it gradually falls into a state of decay. Of this class of structures are the umbilical vesicle and the pupillary membrane of the fœtus, the former of which, after having subserved the purpose of its formation, disappears at the close of the third month, the latter between the seventh and eighth. The kidneys are preceded in the embryo by two jelly-like parts, to which the term *Wolffian bodies* has been applied, as they were first pointed out by the celebrated German anatomist Wolff. These bodies, which exist not only in the mammalia, but likewise in birds and amphibia, acquire their greatest bulk about the middle of utero-gestation, after which they gradually diminish by absorption, and at length entirely disappear. The gubernaculum, which is visible in the tenth week of embryotic life, is a thin membranous process, which guides the testicle to the internal ring, and is finally converted into cellular substance. These are instances of atrophy from the cessation of the functions of an organ in the fœtus. After birth changes not less remarkable are to be observed; such, for example, as the wasting of the thyroid body, the supra-renal capsules, and the thymus gland. From the same cause the alveolar processes of the jaws disappear after the removal of the teeth. In the female, the ovaries shrink after the decline of the menses; and, in conformity with the same law, the testicles often remarkably diminish in size in monks, who lead a life of celibacy, in the strict observance of their vows.

Atrophy may result, secondly, from a diminution of the nervous influence, a circumstance not surprising when it is recollected how much the action of the capillaries is under the control of the cerebro-spinal axis. Whole limbs sometimes waste from this cause: in other cases, the lesion is more limited,

and implies a very partial disorder of the nerves. Dr. Townsend observes that, when the atrophy is caused by disease of the brain, it occurs much more slowly than when it is occasioned by an affection of the nerves of the part. The reason of this difference is not very obvious.

The most remarkable examples of atrophy of the extremities are those which result from pressure on the axillary and sciatic plexuses. A few years ago I had under my care a young man who had received a dislocation of the humerus fifteen months before, which was permitted to remain unreduced. The head of the bone rested on the brachial nerves, and, although the limb retained a considerable degree of motion, the muscles were exceedingly soft and wasted in comparison with those of the other arm. Professor Lobstein,\* of Strasburg, mentions a somewhat similar case, which he observed in a man fifty-four years of age. When a child, he was thrown down in the street, and, soon after, the right limb became very feeble, soft, and reduced in size. On dissection, all the muscles were found extremely pale, and as thin as membranes; the gastrocnemius and soleus weighed less than three ounces, whilst those of the sound limb weighed nearly eight,—the tendo-achillis of the former being only two lines in thickness, of the latter, five. The right hip-bone was considerably reduced in size and thickness, and the corresponding femur weighed only three ounces, two drachms and a half, whilst that of the opposite side weighed nearly double. The nerves themselves, as well as the bloodvessels of the diseased extremity, did not seem to be perceptibly altered.

Another cause of local atrophy is a deficient supply of sanguineous fluid. When any part is deprived of its usual quantity of blood, it very soon becomes enfeebled, its substance is rendered pale and flabby, and at last it loses the power of action, although every other condition for its performance may remain unimpaired. Thus the testicle wastes after tying the spermatic artery; and, for the same reason, the muscles of the lower extremity frequently shrink after securing the principal vascular trunk of the thigh. Atrophy of the heart is sometimes produced by ossification of the coronary vessels, and Lobstein records a case in which the spleen was not larger than a filbert, from the obstructed condition of its artery. In old age, as was before intimated, many of the capillaries are obliterated; and it is not improbable that to this circumstance is owing that diminution of the size of our organs, which constitutes senile atrophy. To the same cause is to be attributed the wasting of the lung and heart, when fluid is accumulated in the pleuritic and pericardiac cavities.

A fourth cause of atrophy, and the last that need be mentioned, is inflammation. The irritation excited by the presence of biliary concretions in the gall-bladder is sometimes followed by complete wasting of that organ. Hepatitis often gives rise to atrophy of the parenchymatous structure of the liver, and orchitis, especially when supervening on mumps, is not unfrequently succeeded by impotence. How the lesion is produced, in these cases, it is not easy to determine. It is probable that the chief fault is in the arterial capillaries, which cease to perform their accustomed functions, and thus allow the absorbents to carry off more than the usual amount of organic matter.

\* *Traité d'Anatomie Pathologique*, t. i., p. 90.

## CHAPTER XIV.

## OF FISTULES.

Definition. — Distinction into Complete and Partial. — Most common Situation. — Nomenclature. — Length and Diameter. — External and Internal Orifices. — Direction. — Lined by Adventitious Organized Membrane. — Nature of the Discharge. — State of the adjoining Tissues. — Causes.

A FISTULE is a narrow track, straight or tortuous, of variable depth, having generally two distinct orifices, lined by an adventitious membrane, and bathed with a thin, gleety fluid, intermixed with the natural contents of the part, organ, canal, or cavity affected. The term is of Latin origin, and literally signifies a pipe, reed, or flute. The disease, which is always of a consecutive nature, occurs in different regions of the body, and is developed under the influence of various causes.

Although the abnormal track has usually two openings, one of which is superficial, and the other deep-seated, yet this is by no means constantly the case. Hence the distinction of fistules into complete and partial. The terms recent and old, used by some writers, refer merely to the duration of the disease.

The lesion may occur in almost any situation, but originates most frequently in the anus, the perinæum, the face, groin, and mammary gland. Fistule of the neck, thoracic cavity, the biliary apparatus, the stomach, colon, and small bowel, kidney, pancreas, and urinary bladder is comparatively rare. It takes place in both sexes, and at every period of life; but children and young persons suffer much less frequently than the old and middle-aged.

The nomenclature of fistule is quite extensive, and probably more intricate than that of any other lesion. The names are derived either from the parts in which the abnormal passage is situated, as anal, perinæal, broncho-pleural, and recto-vaginal; or from the nature of the discharge, as salivary, urinary, and stercoraceous.

Fistules vary much in their extent. The longest tracks are those which occur along the spinal column, in connection with psoas abscess. In this affection the matter, which is of a scrofulous character, generally points in the groin, just above Poupart's ligament, in the upper part of the thigh, or lastly, in the ileo-lumbar region, where it ultimately escapes by ulcerative absorption. The channel which is thus established varies in length from six to twelve inches, and is always lined by a well organized adventitious membrane, which continues to secrete for a long time the same kind of fluid as that which was discharged in the first instance. Tracks of considerable length are sometimes met with in the internal organs, as between the kidney and lung, between one coil of intestine and another, or between the urinary bladder and the cutaneous surface. In other situations, on the contrary, the passage is remarkably superficial, hardly two or three lines from the surface, or the cavity with which it communicates.

In their diameter these anomalous tracks are not less variable than in their length. Sometimes they are so small as scarcely to admit the finest bristle; while at other times they are sufficiently capacious to receive a goose-quill, or even the end of the finger. The narrowest tracks usually occur in the lachrymal passages, the salivary glands, the anus, and the perinæum. It is not often that the fistule is of the same uniform diameter throughout; but it is almost always larger at one point than at another.



The external orifice, generally of a rounded or oval shape, may be so narrow, on the one hand, as to be hardly perceptible, or, on the other, so large as to admit the end of a probe, a goose-quill, or a finger. It may have sharp and well defined margins, or be surrounded by a soft, spongy, florid rim; or, lastly, it may be depressed or infundibuliform. The number of external orifices varies in different cases. In general, there is only one, or, at most, two or three; but occasionally, though rarely, there are as many as six or a dozen. When the number is very considerable the affected surface commonly presents a cribriform appearance.

The internal orifice may be of the same size as the external, or it may be smaller or larger. In its shape it is usually irregularly rounded, and it is seldom that it is found multiple, even when the number of external openings is considerable.

In its direction the passage may be perfectly straight; but in a great majority of cases it is more or less flexuous, serpentine, oblique, or winding. Occasionally it forms nearly a right angle with the surface on which it opens. When several tracks exist they often run together, and open by one common orifice upon the reservoir with which they communicate.

A fistule, in its recent state, is nothing more than a raw surface, studded with granulations, and secreting purulent matter. It is, in fact, an ulcer, an open sore, a solution of continuity, which must undergo a process of reparation before it can be justly entitled to its distinctive appellation. The track, however, soon becomes smooth, and is speedily coated with an adventitious membrane, varying in thickness from a mere film to half a line, a line, or even the sixth of an inch. This new layer, at first soft, and easily detached, gradually augments in density, and is at length inseparably united to the parts which it serves to line. Its color, like its consistence, is influenced very much by its age, and by the nature of the secretion or excretion which passes over it. At an early period it is red, pink, or rose; but in cases of long standing it is either white, grey, or slightly bluish. The free surface of the membrane is smooth and polished; or it is rough, mammillated, or studded with villi of various shapes and sizes. The other surface is attached by means of short cellular substance to the parts upon which it lies. Bands of lymph sometimes extend from one side of the abnormal channel to the other, as in the bridle stricture of the urethra; but this is rare.

The membrane above described is formed from the plastic lymph of the blood, and is of the same nature as the pyogenic membrane of a chronic abscess. Around the anus, in the perinæum, and in some other regions, it bears no little resemblance to the mucous tissue, but differs from it in having no epithelium or follicles. It is liberally supplied with vessels, nerves, and absorbents, is the seat of a constant secretion of gleety or other matter, and is liable, like all new textures, to inflammation and its consequences. In ancient cases it occasionally acquires a dense, fibrous, or even fibro-cartilaginous consistence.

The nature of the discharge in this disease varies with the situation of the abnormal passage. In general, it is thin and gleety, as in chronic gonorrhœa, and mingled with the natural secretions, or excretions of the reservoir with which the fistule communicates. When the lining membrane, however, labors under inflammatory irritation, the discharge is either entirely suspended, or it is bloody, purulent, or muco-purulent.

The parts in which the abnormal track is situated are variously affected. In some cases they are nearly natural; but in general they are firm and callous, from the effusion and organization of plastic lymph, which, being often pre-

sent in large quantity, completely obliterates the meshes of the connecting cellular tissues.

Finally, the causes which give rise to fistules are either mechanical or vital. To the first class belong wounds, contusions, and lacerations; to the second, ulceration, gangrene, and the formation of abscesses. There is a variety or form of fistule which may be regarded as a remnant of embryotic organization. Its most frequent situation is the antero-lateral part of the neck. Like the ordinary fistule, it may terminate in a cul-de-sac, or it may have two orifices, of which the external is sometimes scarcely visible. The abnormal passage itself is usually very narrow, and seldom extends beyond two or three lines in depth.

## CHAPTER XV.

### OF TRANSFORMATIONS.

The Body in a state of constant Mutation. — Number of Transformations: the Cellular, Mucous, Cutaneous, Fibrous, Cartilaginous, Osseous and Adipous.

If we trace the human body through the various stages of its existence, it will be found that it is incessantly undergoing changes, by which the nutrition of its elementary constituents is modified, until they are at length converted into totally different structures. Regarded in its primordial state, it is merely a mass of gelatine, wholly devoid of form, and floating about in the midst of a watery fluid; by and by, however, it loses its homogeneous aspect, assumes a more determined shape, blood is formed, organs are constructed, the animal grows, arrives at maturity, is born, and gradually accommodates itself to the circumstances which surround it. But, long ere this event occurs, certain parts have already disappeared; and the process thus begun in the womb, literally continues till the last moments of life. During infancy and adolescence, entire organs, now no longer of any use in the economy, change their character, and are either completely absorbed, or revert to their primitive condition. Thus the thymus gland, which at birth is so large as to cover the whole of the anterior surface of the pericardium, and which consists of a considerable number of distinct lobes, gradually shrinks into cellular tissue, and finally, about the age of thirty, entirely disappears.

So far as an attentive examination of the subject enables me to determine, I feel satisfied that the number of transformations is much smaller than we might be led to infer from a perusal of the works of Andral, Cruveilhier, Meckel, and other authors. Great as my respect is for these writers, and unwilling as I am to detract from their merits, I am nevertheless constrained to say that they have slurred over this branch of pathological anatomy in the most bungling and unphilosophical manner; and that they have confounded things which, one would suppose, it was impossible not to discriminate. These remarks are more particularly applicable to the otherwise excellent treatise of Andral, who, strange as it may seem, has confounded under one general head analogous tissues and analogous transformations, than which nothing can be more erroneous, and, as far as the progress of the science is concerned, more injurious. Is this author really ignorant of the difference between these two pathological states? The idea is preposterous; and yet,

from the manner in which he has grouped them together, one might really be induced to infer that this was the fact. What does the term transformation imply? Does it denote a new growth, a new formation? Certainly not; nevertheless, this appears to be the sense in which it is employed by Andral. If the word means any thing at all, and if it is to be retained in the writings of pathological anatomists, it means, and should be restricted to, those changes which a pre-existing tissue undergoes, as it is being converted into another that is totally different from it, but which has its analogue in the animal economy.

Viewed in this light, the transformations are really few in number, and may be stated as follows: 1. The cellular. 2. The mucous. 3. The cutaneous. 4. The fibrous. 5. The cartilaginous. 6. The osseous. 7. The adipous. To each of these transformations it will be necessary to devote separate consideration; and, in entering upon this duty, I shall only remark concerning them, that they occur most frequently in old age, and that they are all effected under the influence of inflammatory irritation. How far the latter proposition is true, will appear as we proceed.

The *cellular* transformation, on the whole, is much less frequent than some of the others that have just been enumerated. The best illustrations of it are to be found in the peritonæum, the adventitious membranes, the gall-bladder, and the ligaments. The gubernaculum also affords a good example of it. This band, which is entrusted with the office of conducting the testicle from the lumbar region to the scrotum, is of a fibrous nature, which it retains until it has effected the purpose of its creation, when it gradually shrinks into cellular substance. During its descent, the organ in question likewise drags along with it a portion of peritonæum. This process forms an elongated cul-de-sac, somewhat like the finger of a glove, which occupies the inguinal canal, lying in front of the spermatic cord, to which, and to the testicle, it closely adheres. When the descent is completed, the canal is by degrees closed up, and the portion of peritonæum alluded to degenerates into cellular tissue, whilst that over the testicle remains still a serous cavity.

The ligaments, especially the capsular, are sometimes converted into cellular substance. The metamorphosis is most marked in young persons affected with unreduced luxations of the hip and shoulder joints. In such cases it is not rare to find the ligaments of a dull white color, deprived of their fibrous arrangement, and transformed into lax cellular structures. The same thing is occasionally observed in the extremity of an obliterated artery, and in the coats of the gall-bladder, when it is obliged to suspend its functions from some permanent obstruction of its excretory duct. The adventitious serous membranes, particularly the band-like, are often transformed into cellular tissue, more frequently in the pleuritic and pericardiac cavities than in any other situations.

Considering the close connection between the mucous and cutaneous tissues, their similarity of organization and of function, it is not surprising that the one should be convertible into the other. With regard to the former, which serves to line the various outlets of the body, it has only to be exposed to the atmosphere and to repeated friction, and, sooner or later, it is transformed into *skin*, or at least into a substance so nearly resembling it, that it would be difficult to point out any difference between them. The process by which this is accomplished is gradual, and requires some time for its completion. The first thing that is noticed in the exposed membrane is a change of color, which progressively diminishes in intensity, until at length it approaches that of the external cutaneous surface. Whilst this blanching is going forward, the part loses its accustomed sensibility, augments in thickness and density, and becomes cover-



ed with a horny lamella, corresponding with the epidermis. Its absorbing powers are also much lessened, and, instead of mucus, it pours out a thin, watery fluid, analogous to the cutaneous perspiration. This transformation, however, is at best imperfect; and it remains to be shown whether it really consists of the same number of layers as the natural skin.

The cutaneous texture is the only one, it appears to me, which is, strictly speaking, susceptible of the *mucous* transformation. In order to bring this about, the process above described should be, as it were, reversed; that is to say, the skin should be inverted, and excluded from the influence of the atmosphere. Soon after this is done, the epidermis is observed to drop off, and the true skin assumes a deep, florid aspect, becomes extremely sensitive as well as somewhat rough, and deposits a thin, ropy, whitish fluid, in all respects similar to mucus. Analogous phenomena are often witnessed in corpulent persons, especially in infants, who suffer from chafes in the neck, groin, and arm-pit, from neglect of cleanliness.

Cases occasionally occur in which an opportunity is afforded for observing what is termed the *fibrous* transformation. The tissues most liable to be thus affected are the cellular, serous, and vascular, together with the muscular and pseudo-membranous. In whatever situation it occurs, it is in the cellular element that it probably always begins, from which it gradually extends to and involves other textures, its progress being slow or rapid, according to the nature of the affected part, and the intensity of the exciting cause.

In some instances this transformation would seem to be of a physiological kind, taking place in parts that have ceased to perform their functions. Of this description are the vessels which are concerned in carrying on the fetal circulation. These vessels, during intra-uterine life, are of the same structure precisely as the rest of the vascular system, of which they form so many appendages; but no sooner is the child detached from its mother than they are rendered useless, and instead of continuing hollow, which could answer no good purpose, they are gradually closed, and converted into dense, fibrous cords, in which it is impossible to recognize the slightest trace of the original structure. The process which is thus at work is of an inflammatory character, and serves the double purpose of obliterating these superannuated vessels, and metamorphosing their tunics.

Next to the osseous, there is no transformation of such frequent occurrence as the *cartilaginous*. This usually appears in the form of thin plates or nodules, which possess all the properties, both physical, chemical and vital, of the tissue from which they obtain their name. Of all the textures, the subserous cellular seems to be the one that is most subject to this species of transformation. It is also frequent in the fibrous envelopes of the spleen, especially in the inferior animals, in the placenta, the gall-bladder, the parietes of accidental cysts, in adventitious membranes, and in the walls of abscesses and of tuberculous excavations.

The cartilaginous transformation is sometimes seen in the subcutaneous cellular tissue. An instructive case of it is related by Andral, which he observed in a female who died of elephantiasis in the Charity Hospital at Paris. Underneath the skin of one of the inferior extremities, in the place formerly occupied by the muscles, which were reduced to a few pale fibres, was an enormous mass of hard, condensed, cellular substance, possessing all the ordinary properties of cartilage. Is this case one of real metamorphosis, or ought it not rather to be regarded as one of new formation? The latter supposition, I think, is the more plausible of the two.

Still more rarely is the cartilaginous transformation observed in the submu-

cous cellular tissue. Hitherto I have not met with a single well-marked example, and Andral states that he has witnessed it only once. The new substance, seated beneath the mucous lining of the stomach, cut precisely like a piece of costal cartilage, and passed by insensible gradations into the circumjacent cellular tissue, which was unnaturally thick and indurated.

The fibrous transformation, like most others, passes through several stages before it attains its perfect development. "In the pleura, for instance, it is by no means uncommon," says Andral,\* "to observe spots in which the cellular tissue is condensed and indurated, but still retains its natural organization; others in which it is become evidently fibrous; and, lastly, others in which it presents merely a homogeneous white mass, the texture of which is perfectly analogous to that of cartilage."

The most common transformation, by far, is the *osseous*. Although it has been described as occurring in all the tissues, even the nervous and the muscular, it is now well ascertained that it is confined exclusively to the cellular, fibrous, fibro-cartilaginous, and cartilaginous, the frequency with which it takes place being in the order here enumerated. The new substance, which often bears but a very faint resemblance to natural bone, makes its appearance under three principal varieties of form, the lamellated, tuberoid, and spicular. Of these the first is the most common. It is usually met with in the subserous cellular tissue of the chest, abdomen, cerebro-spinal canal, and testicle, where it occasionally forms patches of considerable size, of a pale yellowish color, and from the third of a line to the twelfth of an inch in thickness. It is also seen in the walls of accidental serous cysts, in the interior of fibrous tumors, in the thyroid gland, and in the coats of the arteries. When the patches are numerous, they sometimes coalesce, and thus form a sort of osseous membrane. In this manner I have often seen the largest arteries converted into hard, rigid tubes; and I have a specimen of diseased thyroid gland, which is reduced to a perfect bony shell, the interior being occupied by a soft, cretaceous substance.

The second variety, the tuberoid, is most common in the brain, the parenchymatous organs, and in the interior of serous cavities, whether natural or accidental. The number of concretions, although sometimes considerable, is generally small, not exceeding ten or fifteen. In the lungs as many as five or six hundred have been found in a single subject. Varying in size between a clover-seed and a walnut, they are seldom larger than a cherry-stone, are usually of an irregularly spherical shape, sometimes oval or even angular, more or less brittle, and of a pale straw color: in some instances, they are perfectly smooth, and of a pearly opaline lustre. Whether occurring alone or in groups, they are either enclosed by distinct cysts, or they lie in immediate contact with the tissues or cavities in which they are formed.

Instead of occurring in plates or granules, the accidental substance occasionally appears in the form of little *spicules*, resembling so many stalactites. Varying in length from a few lines to an inch or more, they are rarely thicker than a crow-quill, and are most commonly met with in the subserous cellular tissue of the brain and spinal cord, in the periosteum, and in the cellular tissue between the muscles. This variety, on the whole, is much less frequent than either of the other two.

With respect to its consistence, the osseous tissue, if it be really entitled to this appellation, is subject to much variety. In the great falx of the dura

\* Treatise on Pathological Anatomy, by Townsend and West, vol. i., p. 206.

mater, I have frequently found it as dense and solid as the petrous portion of the temporal bone ; in most other situations, however, it is much softer, and often remarkably brittle. In its structure it may be homogeneous, radiated or reticulated ; but no where, so far as I have been able to observe, does it present an internal cavity corresponding with the medullary canal of the long bones. Chemically examined, it is found, like the natural osseous tissue, to be composed of the phosphate and carbonate of lime, in combination with gelatine. The relative proportions of these constituents are extremely variable, and it not unfrequently happens that one of them is totally absent.

It has been already seen that the osseous transformation is most common in the cellular tissue. This tissue, however, is not equally liable to suffer in all parts of the body. It is seldom witnessed in the subcutaneous cellular tissue, whilst it is very frequent in that of the muscles, and still more so in that of the serous membranes, especially in that of the arteries and of the left side of the heart. The submucous cellular tissue appears to be almost exempt from this transformation ; at all events, I have never seen an instance of it ; and this accords with the experience of Andral and other writers. The fibrous membranes, the cartilages, and fibro-cartilages, are rarely affected except as a consequence of old age, and, what is remarkable, the latter are generally much more frequently involved than the two former, out of which they are constructed, and between which they form the connecting link in the textural scale.

Is the osseous transformation, when it takes place in the cellular tissue, always preceded by the fibrous and cartilaginous states ? Upon this point pathological anatomists are still at variance. If the process be carefully examined, as it occurs in the subserous cellular tissue in different parts of the body, it will be found to involve a series of successive stages corresponding with those that are observed in the ossification of the fetal skeleton. The first change which this substance experiences is a diminution of its natural transparency, accompanied with a slight degree of thickening of the part, and a deposition of turbid, cream-like matter, which is diffused through its areolar texture. As the morbid process advances, the part becomes more and more opaque, is rendered flexible and elastic, assumes a greyish color, and grates under the scalpel. It is now distinctly fibro-cartilaginous ; it is next converted into cartilage, and finally into bone, the particles of osseous matter being deposited at different points, which gradually augment in diameter, and at length, running into each other, thus completely change the primitive character of the part. The period required for the perfection of each of these changes cannot be determined ; in some instances there is reason to believe that it is very short, whilst in others it embraces several months, or even years.

Such, in a few words, is the process which nature ordinarily employs to accomplish this transformation. I say ordinarily, for there are cases, as every one must be sensible, in which the process is much less complicated, and in which the osseous matter is deposited without any antecedent alteration in the structure of the part. This mode of ossification is most common in the cellular tissue of the arteries, and in that of the valves in the left side of the heart : it is also occasionally seen in the parietes of serous cysts, and in the cellular tissue of the muscles.

Accidental ossification is frequently an effect of old age. There are very few persons, beyond the fiftieth year, in whom the arteries, to say nothing of the mitral and aortic valves, together with the costal and laryngeal cartilages, are not thus affected, and this often to a surprising extent. In other cases, it is directly chargeable to inflammation, sometimes of an acute but mostly of a chronic nature. The ossification of the pleura in pulmonary phthisis, of the



vaginal tunic in old hydroceles, and of the arachnoid in chronic hydrocephalus, is unquestionably to be referred to this cause and to no other. So also with regard to the ossification of the periosteum during the formation of callus, of the walls of old abscesses, and the linings of tubercular excavations of the lungs. How far the examples of senile transformations above adverted to are influenced by, or unconnected with, inflammation, is a question concerning which we have no positive information. For my own part, I am disposed to believe that it is not altogether absent even here, although it may not be characterized by the phenomena that physicians are in the habit of ascribing to it.

The most remarkable transformation, perhaps, of all, is the *adipous*, concerning which very little appears to have been known until within the last fifteen or twenty years. Notwithstanding the great attention that has been bestowed upon it by some of the European pathological anatomists, it must be acknowledged that we are still entirely in the dark, both as respects its intimate nature and its exciting causes. By some the alteration is supposed to consist essentially in the superaddition of fatty matter to the existing tissues, whilst others consider it as the result of a true transformation, the same in principle as the fibrous, cartilaginous, or osseous. Whatever doubts may still exist upon the subject, it seems to me that both views are, to a certain extent, correct. At all events, my own observations have fully convinced me that there are cases in which the fatty matter is literally infiltrated into the interstices of the different organs, imparting to them a greasy color and consistence. On the other hand, I am equally certain that a transformation, properly so called, of this kind takes place in different structures, especially in the liver, kidneys, pancreas, heart, and muscles, parts in which it is most frequently witnessed. An organ that is thus affected is generally of a pale straw-color, diminished rather than increased in consistence, is easily torn, receives the impression of the finger, greases the scalpel which is used in cutting it, is of lighter specific gravity than in the natural state, and contains from one third to one half its own weight of yellow concrete oil. Such are the changes which ordinarily attend this transformation, and the question now presents itself, how are they brought about? In the liver of the inferior animals, as will be shown in another place, this degeneration can often be produced at will, simply by subjecting them to rest in a dark apartment, and cramming their stomachs with rich, stimulating food, which, by creating obstruction in the portal circle, in all probability induces inflammation in the hepatic tissues. In the human subject it is occasionally connected with general hypertrophy of the adipous tissue, and instances have been observed in which it appeared to depend upon the want of exercise of the affected part. The latter opinion is entitled to consideration chiefly from what occurs in the muscles of the inferior extremities of old persons who have long labored under paralysis. In such cases, the muscles often assume a pale color, are remarkably soft and flaccid, and exude a clear, oily fluid on pressure, their fibres, however, remaining perfectly distinct. But are these effects really attributable to the repose in which these parts, under the circumstances referred to, are placed? Would it not be more philosophical, in the absence of more satisfactory evidence, to conclude that something was due to the want of nervous influence, and to the altered state of the circulation thence arising? Be this as it may, I feel disposed to think that the transformation in question, like the cartilaginous and osseous, indeed, like every other, is uniformly the result of a low and imperceptible grade of inflammatory irritation. The subject, however, requires further investigation.

The discussion of the foregoing topics might have been extended much further, but what has been said must suffice. In considering the pathological

anatomy of the various tissues and organs, ample opportunity will be afforded for supplying deficiencies, and entering into details which could not well be noticed in the present chapter.

## CHAPTER XVI.

### OF PNEUMATOSIS, OR COLLECTIONS OF AËRIFORM FLUIDS.

Definition and History.—Frequency.—Names by which it is known.—Form and Extent.—Physical and Chemical properties.—Causes.—Effects on neighboring Organs.—Most frequent in the Female.—Duration.—May be expelled or absorbed.

THE term pneumatosis, devised, I believe, by P. Frank, is employed to designate a class of affections, which consist in the introduction, development, accumulation, or exhalation of air, gas, wind, or aëriform fluids in the various organs, tissues and cavities of the body. Collections of this kind were noticed by different observers at a very early period of the profession. In 1582 the various gaseous exhalations were made the subject of a distinct monograph by Fyeus, a physician of Anvers, under the title of “*Flatibus Humanum Corpus Molestantibus*.” This, after a considerable interval, was followed by the works of Stahl, Combalusier, Reil, Ackermann and Foderé, together with several others of minor note, not necessary to be mentioned. One of the latest treatises on the subject is that of Baumès, the second edition of which was issued at Paris in 1837. A very excellent dissertation on the morbid secretion of gases was published in 1841, by J. L. Siemens, a graduate in medicine of the University of Groningen.

From the above remarks, it will appear that the various gaseous affections of the human body were long ago investigated and described as special morbid conditions by a considerable number of pathologists. Nevertheless, it must be confessed that our information concerning them is still very limited and imperfect, which is so much the more to be regretted when we consider their real interest.

Collections of aëriform fluids are much more common than is generally supposed. They occur in various parts of the body, exhibit much variety as to degree and extent, give rise to very serious and sometimes even fatal effects, and are frequently so obscure in their character as to be mistaken for other affections.

Various *epithets*, derived for the most part from the anatomical name of the affected organ, tissue, or cavity, have long been employed to designate these gasiform collections. Thus, when the disease is seated in the chest, it is denominated pneumo-thorax; in the abdomen, tympanitis; in the uterus, physomatra; in the heart-bag, pneumo-pericardium; in the scrotum and vaginal tunic, penumatocele; in the general cellular tissue, emphysema.

The *form* in which the effused air or gas appears is liable to considerable diversity, dependent chiefly upon the nature of the part affected. In the cellular substance it presents itself in the shape of a tumor, not prominent and circumscribed, but more or less diffused, soft, elastic, and emitting a peculiar crepitating or crackling sound on pressure. In the lung, where it constitutes one variety of emphysema, it occurs in narrow, bluish bands, or patches, from a line to half an inch or even an inch in breadth. When the aëriform fluid

escapes from the inter-lobular septa into the cellular structure between the pleura and the lung it forms moveable vesicles, blebs or bubbles, of a whitish, pearly appearance, and about the size of a currant or small bead. Similar phenomena take place in the vessels of the pia mater, in the cellular tissue between the pia mater and the arachnoid, and in the submucous cellular substance of the intestinal tube. In the first of these situations the air usually forms a congeries of transparent vesicles, which are rendered beautifully distinct by their contrast with the blood which not unfrequently separates them partially from each other. In the serous membranes the fluid is either extensively diffused, or it is confined by bands of plastic lymph to particular portions of these sacs, forming, so to speak, circumscribed windy bags.

In its *extent* the accumulation may vary from a few globules to many cubic inches. In the splanchnic cavities, particularly that of the abdomen, it may be so great as to lead to very serious distention of the walls by which they are enclosed, or of the organs which are contained in them. The bowels are sometimes puffed out many times beyond their natural dimensions; their muscular fibres are paralyzed; the function of defecation is entirely suspended; and life is destroyed by the effects of the compression of the diaphragm and adjoining viscera. In the subcutaneous cellular tissue the quantity of effused fluid is sometimes very great, extending over an entire limb, one side of the trunk, or even the entire body. In the lung, submucous cellular tissue, and blood-vessels, the development is generally very small, sometimes hardly perceptible. Considerable quantities of gas are occasionally collected in the uterus, in the cellular substance of a mortified limb, and in the interior of a sphacelated hernia.

The *physical and chemical properties* of the æriform fluid are influenced by a number of circumstances, of which the most important are, the period during which it is retained in the system, the absence or presence of disease in the part affected, and the nature of the concomitant effusion, whether this be serous, purulent, or bloody, alone, or in a state of combination. In the lungs and subcutaneous cellular tissue, where the extravasation is most commonly the result of some injury, the fluid is generally inodorous, perfectly transparent, and in all respects similar to the atmosphere from which it is originally derived. In the pleura and pericardium, in the uterus, in certain abscesses, and, above all, in the intestinal canal, it is often remarkably fetid, and charged with various kinds of gases, — oxygen, hydrogen, nitrogen, and carbonic acid, — the relative proportions of which vary much in different cases and in different circumstances. When the hydrogen predominates the fluid may be so thoroughly impregnated with it as to be inflammable; while, on the other hand, if there be a great redundancy of carbonic acid, it may be incapable of sustaining combustion, and readily extinguish a lighted taper. In the alimentary tube the fluid frequently contains a considerable quantity of sulphuretted hydrogen, and the same substance occasionally exists, though more sparingly, in the gaseous accumulations of the uterus, pleura, pericardium, and peritonæum. The air which is developed in scrofulous abscesses is sometimes remarkably fetid, probably from the same cause.

Considered in relation to the *causes* by which they are produced, and the morbid condition of the parts in which they are developed, æriform accumulations may arise in a variety of ways, and under very different circumstances. Hence the several kinds of pneumatosis may with great propriety be arranged under the following heads: — 1. Pneumatosis from the presence of a wound, laceration, or perforation: 2. Pneumatosis from the operation of chemical agents. 3. Pneumatosis from exhalation, or the influence of a true vital process. Let us consider these causes somewhat in detail.



1. Pneumatosis from external injury is most frequently noticed in the subcutaneous cellular tissue, where it sometimes occupies a great extent of surface, and forms, as was previously intimated, a soft, elastic swelling, emitting a peculiar crackling sound on pressure. The air, in consequence of the permeable nature of the structure in which it is lodged, may be readily pushed from one place to another, and often travels with great rapidity to points very remote from the one originally affected. Whether it experiences any changes in its chemical or physical properties in its passage, or during its sojourn, our information does not enable us to determine. Another form of this variety of pneumatosis occurs in the pulmonary tissue, usually from the rupture of one or more of the air-cells, and the consequent diffusion of the atmosphere through the connecting cellular substance. The appearance which the extravasated fluid presents here has been already pointed out. The air may remain in its original situation, or it may escape into the mediastinal cavity, and thence spread over the cellular tissue of the neck, head, and upper extremities. To the same class of affections belong the collections of æriform fluids in the pleuritic cavity, from the ulceration of a bronchial tube. On this occurrence, which is by no means infrequent, the air rushes into the cavity in question, where, if there be no adhesions of the contiguous serous surfaces, or considerable accumulation of serum, pus, or lymph, it may lead to severe compression of the pulmonary tissues, and so cause great embarrassment in the respiratory function. In perforation of the intestinal tube, whether occasioned by a wound or by ulcerative absorption, large quantities of air sometimes find their way into the peritonæal cavity, producing more or less distension of the abdomen, and a hollow, drum-like sound on percussion.

Finally, the air may be introduced directly from without through the natural inlets of the body, as the intestinal tube, the vagina, and the uterus. A considerable quantity of air constantly finds its way into the stomach along with our alimentary substances, and many individuals, as has been shown by the experiments of Gosse and others, possess the faculty of swallowing this fluid at pleasure. In the vagina, air may be drawn up into this tube while in a relaxed state, and afterwards explode with a considerable noise. Of this occurrence many well-authenticated instances are upon record. The air may be retained for some time, or it may pass off soon after it has collected; it may be confined to the vagina, or it may ascend into the uterus, especially if the orifice and neck of that organ are unobstructed. Well-marked and even large accumulations of air are occasionally met with in the urinary bladder, probably from the direct introduction of the fluid through the urethra, though it may be difficult, especially in the male, to explain the manner in which this is effected.

2. The second class of causes, capable of producing pneumatosis, are of a chemical nature. Of this, the best examples are afforded by the uterus, in consequence of the retention of some extraneous substance, either solid, semi-solid, or liquid, as a piece of placenta, a portion of the fœtal membranes, a blighted ovum, a clot of blood, a mass of lymph or mucus, or the menstrual fluid. Whenever any substance of this kind is prevented from passing off, from the want of expulsive power of the womb, or the existence of some mechanical obstacle at the mouth or neck of that organ, it must necessarily undergo putrefactive decomposition, and thus give rise to the extrication of gas or air, usually more or less fœtid in its character, and sometimes even inflammable. The quantity of gas evolved may be very considerable, or so trifling as to be scarcely perceptible; and the process upon which its elimination depends may continue in operation for several weeks, months, and even years.

Very considerable accumulations of gas sometimes take place from the partial

decomposition of sero-purulent fluids. This phenomenon is most frequently noticed in the thoracic cavity, as a complication of chronic pleuritis; but may also occur in the pericardium, peritonæum, and even in the vaginal tunic of the testicle. To the same class of affections may be referred the æriform fluids met with in scrofulous abscesses and in the sero-purulent collections of the larger joints, particularly that of the knee.

Another good example of this class of causes is afforded by what occurs in mortification. No sooner is a part in a high state of inflammation deprived of its vitality, than it yields to the influence of the physical agents by which it is surrounded. Decomposition is speedily set up, and gas, usually of a highly offensive character, continues to be evolved until nature succeeds in casting off the slough. This variety of pneumatosis is frequently observed in sphacelated hernia, and sometimes, though more rarely, in mortification of the pleura and peritonæum.

The æriform fluids which are developed in the stomach and bowels are generally produced under the influence of chemical decomposition. The food of man is extremely various in its nature, consisting as it does of a vast number of articles, both vegetable and animal, and hence it is not surprising that the gas which is extricated during digestion and the sojourn of the refuse matter in the intestinal tube, should often deviate, in a remarkable manner, from the normal standard. Van Helmont long ago ascertained that the air contained in the large bowel is not unfrequently inflammable, while that in the stomach and small bowel rarely, if ever, possesses this property. The experiments of Jurine, Magendie, and Chevreul show that the gas of the alimentary canal, in a state of health, is composed of azote, oxygen, hydrogen, and carbonic acid, the latter of which generally exists in greatest abundance in the colon and rectum, where there is also frequently a small amount of sulphuretted hydrogen. What changes, if any, this fluid experiences when there is derangement of the digestive function, has not been determined. We only know that, under these circumstances, it is often evolved in immense quantities, and with a rapidity truly astonishing.

3. It has been contended, thirdly, that the extrication of air, gas, or æriform fluid, is occasionally the result of vital causes, or, in other words, of a process of secretion not unlike that of serosity, lymph, or pus. It is undeniable that pneumatosis often takes place in situations, and under circumstances, which altogether preclude the idea of its being derived in any other manner. The occasional existence of pneumo-thorax, of emphysema of the subcutaneous cellular substance, of pneumo-pericardium, of physometra, and of pneumatosis of the peritonæal cavity, has been maintained by a great number of pathologists, from the time of Lieutaud, Heister, and Fernelius to the present period. John Hunter, in his observations on digestion, long ago asserted, as an incontrovertible fact, that "air is either formed from the blood, or let loose by some action of the vessels, both naturally, and from disease;" and he has adduced the generation of wind within the cavity of the uterus as an evidence of the power possessed by the living organs of separating gaseous fluids from the blood. Since the time of this illustrious physiologist, numerous observations and experiments have been published, strongly corroborative, if not, in fact, conclusive, of this view of the subject. Dr. Rosa, of Italy, was probably the first who ascertained that the blood naturally contains an animal and expansible vapor. Krimer, who repeated his experiments, fully confirmed the truth of his results: he not only showed that such a fluid actually does exist, but he went further, and made a quantitative analysis, from which it appears that one hundred parts are composed of  $52\frac{7}{10}$  parts of oxygen gas,  $20\frac{3}{10}$  of carbonic acid gas, and 20 of

hydrogen gas. Frank and other observers long ago remarked that the arteries of an animal that had been greatly debilitated by copious bleeding frequently contained air. Krimer informs us that, having exposed the aorta of an animal whose circulation had been previously rendered exceedingly languid by the free use of digitalis, he included a portion of it, entirely emptied of its contents, between two ligatures, and on opening it some time afterwards found it full of air. Similar results may be produced by tying a loop of intestine. Gendrin\* ascertained that if inflammation of the villous coat of the bowel be excited by the application of diluted ammonia, boiling water, or alcohol, and the part isolated by ligatures, the enclosed portion will be found, on the subsequent day, in two cases out of five, to be distended by an inodorous gasiform fluid. Similar experiments have been performed, with the same results, by Sebastian, Siemens, and other pathologists.

A debilitated state of the system, from excessive loss of blood, is sometimes followed by the spontaneous extrication of gas in different parts of the human subject. A number of well-attested examples of this kind are on record. I shall cite the following, not that they contain anything peculiar, but simply because they are of comparatively recent occurrence. A man, mentioned by Rérolle, died at the Hôtel Dieu in Paris of repeated attacks of epistaxis: his body, examined fifteen hours after death, and before any decomposition had occurred, exhibited the phenomenon in question in a very striking degree. The clots in the heart and large arteries contained numerous cells filled with gas; air escaped in dividing the different vessels, and in the small veins this fluid was collected in such quantities as to resemble the contents of a spirit of wine thermometer, into which bubble after bubble of air has been introduced. A similar case is related by Dr. Graves of Dublin. The patient, a gentleman fifty-six years of age, after having labored for a short time under violent excitement of the vascular system, was seized with repeated attacks of bleeding at the nose. The hemorrhage, which appeared to be connected with hypertrophy of the heart, produced extreme debility, and was followed in a few days by emphysema in the subcutaneous cellular membrane of the abdomen. A case in which numerous bubbles of air were found, within an hour and a quarter after death, on the surface of the pericardium and pia mater, in the right side of the heart, in the cellular tissue of the right thigh, and in the femoral vein, was reported a few years ago by Dr. James Monat, of Bangalore, in the East Indies. The subject, a dragoon, thirty-two years and a half old, was affected with pain and oppression in the chest, attended with slight cough and high constitutional excitement. Death took place in less than four days from the attack, having been preceded about twenty-four hours by great swelling of the right thigh, from the hip to the knee. The blood was in a dissolved state, the liver softened, the spleen and mesenteric ganglions somewhat enlarged, and the colon slightly ulcerated. The other viscera were healthy.

The following circumstances afford additional evidence that gasiform fluids may be secreted by the vessels: 1. During respiration the pulmonary mucous membrane incessantly absorbs oxygen, and exhales carbonic acid. 2. The air contained in the air-bag of fishes is evidently derived in this manner, and in no other. 3. Vegetables are continually engaged in throwing off oxygen and imbibing carbonic acid.

The preceding facts clearly prove that the development of gasiform fluids may occasionally be the result purely of a secretory process. A majority of the cases that have been adduced by pathologists in evidence of this mode of

\* Hist. Anat. des Inflammations, t. i., p. 582.



production, are, I am fully aware, not entitled to any reliance from the absence either of proper details, or from the imperfect manner in which they were investigated; but that many of them took place precisely as they have been narrated, is, I think, equally true. At all events, I cannot see how it is possible to explain, on any other principle, the facts which they present. The whole subject, however, is involved in obscurity, and much more light than we now possess is required before we can hope to arrive at any very satisfactory conclusions respecting it.

The effects which gasiform accumulations exert upon the surrounding structures vary very much according to their extent and situation. In the alimentary tube, where they are more common than in any other part of the body, they often give rise to serious inconvenience, and sometimes even to loss of life. One of their earliest effects here is debility of the muscular fibres, which may finally end in complete paralysis, followed by excessive distension of the abdomen, and inability to evacuate the fæces. When the accumulation is excessive, or protracted, the coats of the canal may become softened and even lacerated; an occurrence of which many examples are on record. Large collections of gas occasionally take place in the bowels from the presence of organic disease, spasmodic stricture, or hardened fæces; and in such cases death may happen from over-distention of the alimentary tube, producing pressure upon the diaphragm to such a degree as to arrest respiration.

In the pleural sac the effused fluid may not only compress the lung, but even displace the heart. When the pericardium is distended, the contained organ will necessarily suffer more or less functional disturbance, though the air is probably in most cases speedily absorbed. In the uterus the accumulation of gaseous fluid may be mistaken for pregnancy, since it gives rise to more or less enlargement of the abdomen, and sometimes even considerable swelling of the mammary glands. In general emphysema the movements of the body are impeded, and the patient occasionally perishes from the pressure excited by the effused fluid upon the vital organs.

Pneumatosis may occur in several situations at the same time, or, as it leaves one part of the body, it may make its appearance in another. It may exist as a separate and independent affection, or it may be complicated with other diseases, of which irritation and inflammation, with the various products of the latter, are the most common.

Spontaneous pneumatosis may occur in both sexes, and at any period of life, but is most frequent in women, about or soon after the decline of the menses. Various diseases predispose to it, and persons of a weak, nervous habit are more liable to suffer from it than such as are strong and robust. The affection may be developed with great rapidity, but generally takes place gradually, and may last for a number of hours, several days, or even a much longer period. In a case of *physometra* mentioned by Ercoliani,\* the air continued to escape for several successive years. In some instances the generation of gas assumes an intermittent type, recurring in regular paroxysms once every twenty-four hours, or once every other day, like an intermittent fever. There seems occasionally to be a sort of *flatulent diathesis*; that is, the patient suffers habitually from windy accumulations of the stomach and bowels, so that he seldom knows what it is to be entirely free from colicky pains. It has also been supposed that pneumatosis may be hereditary, but of this we have no positive evidence.

\* American Jour. Med. Sciences, vol. iii, N. S., p. 488.

Finally, the effused air may be discharged as fast as it is extricated ; remain for some time, and then escape ; or be retained permanently, as it were, and give rise to the bad effects already pointed out. Under favorable circumstances it may be absorbed, particularly when it is diffused through the cellular substance.

## CHAPTER XVII.

### OF POLYPES.

Most common situation. — Not peculiar to the Human Subject. — Number, Size, and Form. — Structure and Varieties — Vesicular, Fibrous, Vascular, and Granular. — May degenerate in different ways. — Period of Life most liable to their Formation. — Effects on contiguous Structures. — True character. — Are always covered by a Mucous Membrane.

A POLYPE is a morbid growth, organized, vascular, and presenting itself in the form of a pendulous tumor, more or less firm, rarely exceeding the volume of a hen's egg, varying in structure and other properties in different parts of the body, and generally attached by a short neck or pedicle to the surface of a mucous membrane. The term is of Greek derivation, and was no doubt originally employed on account of the resemblance which this excrescence was supposed to bear to certain zoophytes. It is evidently not very appropriate, but as its import is fully understood by pathologists it would only occasion confusion to change it.

Although all parts of the mucous system, with the exception, perhaps, of the gall-bladder, the ureters, and Fallopian tubes, are liable to these growths, yet there are some in which they are much more frequently observed than in others. Their most common situation is unquestionably the nose ; next in order is the uterus ; then comes the maxillary sinus ; then the rectum ; and, finally, the vagina. In the alimentary canal, apart from the portion of it just specified, they are most frequent in the pharynx and the colon. They are occasionally met with in the larynx and trachea, frontal and sphenoidal sinuses, the gums, external ear, urinary bladder, lachrymal sac, urethra, and vulva ; but their occurrence here is extremely rare.

Polypes are not peculiar to the human subject. They have been noticed in a number of the inferior animals, particularly the horse, ass, cow, and dog, in which their occurrence is by no means infrequent. Their most common situation in these quadrupeds, as in man, is the nose, uterus, and maxillary sinus. In the horse these vegetations have been found in the stomach by Wepfer, Hartmann, Chabert, Dolæus, Gohier, and other observers. In the dog they are said, by Huzard,\* to be quite common in the vagina and uterus, where they sometimes attain a large bulk, and are productive of much distress.

The number of these bodies is much influenced by their structure, and by the nature of the cavity in which they are developed. The harder varieties are almost always solitary, while the softer are frequently multiple, or, what is the same thing, occur in groups or clusters, to the number sometimes of six or even a dozen. Cases, indeed, have been recorded in which there were as many as twenty or thirty. This, however, is rare. The nose is the part in

\* *Esquisse de Nosographie Vétérinaire*, p. 190. Paris, 1820.

which they are most numerous, though even here there is often not more than one. In the uterus, maxillary sinus, vagina, alimentary canal; in fact, in most of the situations above specified they are usually solitary. In the rectum, however, as many as four have been observed in the same subject, and in the vagina they are sometimes quite numerous. Tumors of this kind occasionally co-exist in different parts of the body, particularly in the nose and uterus.

In their size polypes vary from that of a pea to that of an almond, a walnut, and even the fist. The soft varieties are usually much smaller than the hard, which now and then acquire an enormous volume. In the uterus a fibrous polype has been known to be as large as a child's head, or to measure from ten or fifteen inches in length by six or eight in breadth. In the nasal fossæ, where they must necessarily be comparatively small, they frequently extend down into the pharynx, depressing the arch of the palate, and touching the root of the tongue. In the uterus they gradually pass into the vagina, and ultimately protrude at the vulva, from which they may descend many inches between the thighs. In the stomach they have been found more than eight inches in length by upwards of an inch in diameter. In the maxillary sinus, notwithstanding the firm and resisting character of its walls, they often acquire an immense size, especially when of a malignant nature.

The form of these vegetations, like their number, is greatly influenced by the cavity in which they are situated, and by the pressure which is exerted upon them by the surrounding structures. In the nose and uterus they are generally conical or globular, with a tolerably distinct pedicle, while in many other parts, as the stomach, pharynx, and bowels, they are cylindrical, or of the shape of a leech or earth-worm. In the maxillary, frontal, and sphenoidal sinuses they become usually pretty accurately moulded to the form of the cavity in which they are developed, whatever may have been their appearance in the first instance. In a uterine polype in my private collection, the tumor bears a striking resemblance to a mushroom; the pedicle, which completely closes the orifice of the organ, is about an inch long, and terminates in a bulbous expansion, nearly fifteen lines in diameter. When of a globular figure, the polype commonly adheres by a tolerably broad base; but if conical or cylindroid, it is almost always provided with a well-marked pedicle, narrow neck, or footstalk, which is from half an inch to an inch or even two inches in length by several lines in diameter, rounded, and often of unequal thickness in different portions of its extent. Sometimes the pedicle is very much elongated, constituting what some of the French writers have denominated the "pendulous polype." Occasionally, two or three tumors grow from a single stalk, and in some instances, though they are rare, the free extremity of the polype has a bifid, grooved, fissured, knobby, or tuberculated arrangement.

In relation to their structure, polype may be referred to four principal species, the vesicular, fibrous, vascular, and granular. To these some writers, as Deschamps, Alibert, and Gerdy, have added several others, as the sarcomatous, lardaceous, cartilaginous, osseous, and mixed; such a distinction, however, is obviously improper, inasmuch as all these formations are the result entirely of secondary changes, produced in these bodies by irritation, diseased action, or perverted nutrition.

The *vesicular*, gelatinoid or cellular polype is most frequently observed in the nose, though it is also occasionally met with in the other mucous cavities. It is of a soft, spongy consistence, homogeneous, frequently semi-transparent,



and usually of a greyish, yellowish, violet, or pale greenish color. The surface of the tumor may be perfectly smooth and uniform, but more commonly it is somewhat rough, lobulated, or divided into ridges; vessels, sometimes of considerable length and volume, often ramify over it in different directions, without apparently entering its interior. This variety of polype occurs either singly or in clusters, and consists essentially of cellular tissue surrounded by a thin, glossy, pellucid membrane, evidently of a mucous nature. When punctured, a yellowish, whitish, or lactescent serosity escapes, slightly coagulable by heat, alcohol, and acids, and followed by a sensible diminution of the volume of the tumor. Its form, which is commonly conical or globular, is greatly influenced by the cavity in which it is situated; it is generally supported by a well-marked neck or pedicle; grows with considerable rapidity; is void of sensibility; readily breaks under pressure; and is always hygrometric, expanding when the atmosphere is moist, and decreasing when it is dry. The vesicular polype bears no little resemblance, both in its color and consistence, to the common oyster, or a lump of hardened jelly. When extirpated it is very apt to be reproduced.

The *fibrous* polype is so named from its structure, which strongly resembles that of a fibrous tumor. Its most common seat is the uterus, but it likewise occurs in the maxillary sinus, in the nose, in the alimentary canal, and, perhaps, also, in some of the other mucous passages. It is distinguished by the extreme firmness of its texture, which equals that of tendon, fibrous membrane, or even fibro-cartilage. It exhibits a faintly striated, linear, or thread-like arrangement, and is composed of whitish, reddish, or greyish filaments, which interlace with each other in various directions, and are held together by a sort of glutinous substance, the quantity of which is usually in an inverse ratio to the density of the morbid mass. A polype of this kind is more or less elastic, slightly, if at all, compressible, opaque, and of a pale reddish, lilac, or greyish color. Sometimes it has a marbled or mottled appearance, and occasionally it is almost as white as a fibrous membrane. It is generally supported by a tolerably broad base, instead of a narrow, rounded pedicle; possesses very little or no sensibility; has few blood-vessels; is covered by a reflection of the mucous membrane; grows very tardily, though it often acquires a large bulk; and is much more apt than the other species to degenerate into malignant disease. Different sections of it often exhibit different structures, and in a few instances it is found to contain one or more cavities, which are either empty, or filled with grumous blood, milky fluid, gelatinous matter, or fat and hair. The fibrous polype always occurs singly, never in groups or clusters, as is the case with the vesicular and granular.

The third species of polype is the *vascular*, which, in comparison with the vesicular and fibrous, is extremely rare. It is occasionally found in the nose and maxillary sinus, but is most common in the rectum, external ear, vagina, and uterus. It is of a soft, spongy consistence, bleeds with great facility when touched or irritated, and is composed of a great number of vessels, which, intersecting each other in different directions, are supported by a large quantity of cellular tissue, and surrounded by a delicate mucous membrane. Its color is usually florid, deep red, or purple, especially when it is handled, compressed, or exposed to the air. In its size it varies from that of a cherry to that of a hickory nut, a hen's egg, or even a moderate-sized fist. It rarely, however, acquires much bulk; and notwithstanding its vascularity, its growth is usually slow, so that a number of years may elapse before it leads to much inconvenience.

The vascular polype is generally attached by a small pedicle, and is almost

always of a conical, globular, or ovoidal form. A tolerably large artery, accompanied by one or two moderate-sized veins, usually passes along the pedicle, and ramifies through the substance of the tumor, which it pervades in every possible direction. Hence it is usually erectile during life, and more or less flaccid after death.

The *granular* polype, probably the least frequent of any, is chiefly found in the uterus, though it also occurs in the nasal fossæ and in the urinary bladder. Andral and Ferrus have each met with an example in the larynx. Appearing almost always in clusters, which are sometimes spread over a considerable extent of surface, it varies in size between a currant and a grape, and is suspended by a rounded, delicate pedicle, often not thicker than a hempen thread, and from an inch and a half to two inches in length. It is of a pale rose, whitish, or greyish color, homogeneous, granular, soft, inelastic, and exhibiting something like glandular flesh when cut into, the incision being occasionally followed by the exudation of a very small quantity of serous fluid. The polype is very easily detached from the surface on which it grows; is covered by an exceedingly delicate membrane; increases very slowly in size; and is apt, if repeatedly irritated, to degenerate into cancer. No vessels are apparent to the naked eye, and unless it is ulcerated, or otherwise diseased, it does not evince any sensibility.

The different forms of polypous tumors, of which we have given a brief description, may, in consequence of disease, to which, in common with other morbid growths, they are more or less liable, undergo various transformations, so as to justify, in some degree, the classification of Deschamps, Alibert, and other pathologists, above alluded to. The most common of these changes are the carcinomatous, lardaceous, fibro-cartilaginous, cartilaginous, osseous, and earthy. None of these, with the exception of the first two, pervade the entire tumor, but occur in isolated masses, with intervening portions of sound substance. Nevertheless, Job à Meekren\* and Paul Barbette,† each mention a case of cartilaginous polype; and Schlevogt‡ alludes to a tumor of this sort, removed from the nose of a cow, which was completely ossified, extremely hard, and weighed two pounds. Cruveilhier§ describes a similar tumor, which he found in the maxillary sinus of an old woman, seventy-eight years of age. It was of the volume of a large turkey egg, rough, and of bony consistence. Small cysts, containing various kinds of fluids, serous, bloody, milky, or even purulent, are sometimes scattered through the substance of the morbid growth; and I have in my possession a nasal polype, in which there are several tubercular deposits, of the same nature as those found in the lungs and other parts of the body.

The fibrous polype is by far the most liable to degenerate into malignant disease; and next to this is the granular. As to the other varieties, they are rarely, if ever, affected in this manner. When the tumor assumes this kind of action, it usually grows with great rapidity, extending in all directions, and breaking down everything before it. It is of a deep red, brown, or livid color, is traversed by large, tortuous vessels, and is extremely prone to bleed upon the slightest touch, or under the most trifling irritation. Its sensibility is much augmented; pains dart through it in various directions; the whole system deeply sympathizes; the countenance exhibits a sallow, cadaverous aspect; the general health is rapidly undermined, and the patient, worn out by suffering, sinks into the grave; the tumor, in the meanwhile, having opened at various points, and thrown out fungous excrescences. Examined at this

\* Obs. Med., c. 12, p. 79.

† Chir., c. 1, hist. 2.

‡ Gerdy, Des Polypes, p. 98.

§ Essai sur l'Anatomie Pathologique, t. 1.

stage of the malady, the morbid mass is found to be of a soft, brain-like consistence in some parts, lardaceous, scirrhus, hæmatoid, fibrous, or fleshy in others; the whole presenting a strange combination of disease, in which the surrounding structures, bones, cartilages, muscles, nerves, and vessels are often inseparably blended.

The period of life most liable to these morbid growths varies according to their structure, and the nature of the cavity or canal in which they are developed. In the rectum, they are most common in children under ten years; in the uterus, between thirty and forty; in the nose, in young adults; in the larynx, in advanced life. From the fact that they have occasionally been observed within a few weeks or months after birth, it is probable that they may sometimes be congenital. It would also appear that the disease may occur in several members of the same family, whence it has been inferred that it might be hereditary; of which, however, there is not, as yet, sufficient evidence.

We have no statistical facts which enable us to determine whether one sex is more liable to them than the other; the probability, however, is, that they are more frequent in women than in men. We are equally in the dark respecting the influence exerted upon the production of this disease by temperament, occupation, climate, and season.

The pathological effects of polypes on contiguous structures vary according to the volume, form, and situation of the tumor. As long as they are inconsiderable they cause little trouble or inconvenience, except, perhaps, in the uterus, where even a small body of this kind may occasion profuse and repeated hemorrhage. In proportion as they increase in size they manifest a disposition to press upon the walls of the cavities in which they are confined, or, if these cavities have a natural outlet, to pass beyond them, and encroach upon the circumjacent parts. Thus, in the nose, they frequently extend backwards into the fauces, and forwards into the anterior nares, while above they may press upon the turbinated bones, laterally upon the lower and upper jaw, and inferiorly upon the roof of the mouth. In the maxillary sinus, after having filled that chamber, they usually encroach upon the eye, lachrymal sac, nose, mouth, and face, thrusting them out of their natural position, and thus causing not only much deformity, but more or less functional disturbance. A polype of the nose produces mechanical obstruction, attended with difficulty of breathing and a change of voice, which is often hoarse or croaking, as if the individual was labouring under cold. In the larynx, excrescences of this kind occasion dyspnœa, alteration or extinction of the voice, suffocative paroxysms, and a sense of uneasiness and of constriction in the region of the part affected. In the rectum a polypous tumor has been known to cause fatal obstruction, from retention of the fæces.\* In the bladder the disease is attended with frequent micturition, with temporary inability to void the urine, and is liable to be followed by the worst consequences.

In the uterus the most important effect by far is excessive loss of blood. The hemorrhage, which is often very copious, recurs upon the slightest exertion, and usually persists, with various intermissions, until the foreign body is removed or expelled. The quantity of blood lost may amount to many ounces or even pounds. It may be discharged in a fluid state, or be retained for a time, and then come away in clots. A polype may also occasion prolapsus of the womb, or even inversion, especially if it be attached to the fundus of the organ, and be of great weight, so as to lead to constant dragging and expulsive efforts. "The presence of a small polype does not prevent conception, although it renders the continuance of utero-gestation very doubtful, inasmuch

\* Meckel's Neues Archiv., B. i.; Voigtel, Handbuch der Pathol. Anatomie, B. ii., p. 649.



as it frequently causes abortion." I have already referred to a tumor of this nature, of the shape of a mushroom, which so completely closes the mouth of the womb as to cut off all communication between the interior of that viscus and the vagina.

Polypes cannot be regarded, strictly speaking, in the light of new formations, but rather as the result of a species of hypertrophy of the mucous membrane, either alone, or conjointly with the textures over which it lies, and to which it is more or less intimately attached. That this is the case may be easily proved by an examination of the anatomical elements of which these tumors are composed. Thus, the granular polype, as it is called, evidently consists of an enlargement of one or more of the mucous follicles, which every where exist in the mucous membranes, though much more numerous in some situations than in others. These little bodies are particularly abundant at the neck of the uterus, and hence the reason probably why this species of tumor is almost exclusively confined to this organ. When these glands are irritated or inflamed, their outlets become obstructed, either by the adhesive process, or from the retention of inspissated mucus, in consequence of which they augment in size, and gradually assume a pediculated appearance. In the meantime the mucous membrane of the uterus is prolonged over their outer surface, so as to give them a complete investment; vessels extend into them from different points of their circumference, and thus they continue to grow until they exhibit the peculiar form, color, consistence, and structure which characterize them. In its mode of development this variety of polype closely resembles that of an encysted tumor of the skin, which is caused by the obstruction of a sebaceous follicle, and the consequent accumulation and retention of its contents. The principal difference between them is, that the latter is not pediculated, owing to the resistance which it every where meets with from the cutaneous tissues, while the other, projecting into an open space, may readily expand in every direction, and by its weight and dragging produce the footstalk by which it is usually suspended.

The vesicular polype is probably, at least in most cases, nothing but a species of hypertrophy of the mucous membrane, with infiltration and induration of the sub-mucous cellular substance. In the vascular variety of the disease there is a predominance of the vascular elements; the blood-vessels are increased in size, and protruded underneath the villous membrane, forming a soft, spongy, and erectile tumor, of a red florid or purple color, and the seat of frequent hemorrhages. The mucous follicles have nothing to do with its production, and the cellular substance enters but sparingly into its composition; barely sufficient to connect the arterial and venous ramifications, and to form a framework for their distribution. In the fibrous polype there is a prolongation or hypertrophied state of the fibrous texture of the part. In the uterus, where this species of the disease is remarkably frequent, it is not unlikely that a portion of the proper tissue of that organ is the structure originally concerned; in the nose, gums, and maxillary sinus it is probably the periosteum. Blandin\* supposes that this variety of polype is caused by a fibrinous concretion, organized on the outside of the mucous membrane; an opinion which appears to be entirely at variance with the history of this morbid growth.

From the preceding account of the different species of polypes it will be perceived that all these vegetations are covered with a mucous membrane, which is merely a prolongation of that of the cavity or canal in which the foreign body is developed. This investment varies very much in its physical properties, according to the structure, size, and age of the tumor. In the

\* Dict. de Med. et de Chirurg. Prat., t. xiii., p. 453.

fibrous polype it is usually of considerable thickness, opaque, rough, mammillated, tough at some points, and remarkably brittle at others; while in the vesicular, granular, and vascular it is comparatively thin, semi-transparent, or perfectly pellucid, smooth, glossy, and of tolerably uniform consistence throughout. In recent cases, and occasionally even when the tumor is of long standing and of considerable bulk, the membrane by which it is covered is a mere film, requiring the greatest care to demonstrate it. I am in possession of a polype of the rectum, evidently belonging to the vascular variety, which is studded all over with the finest villi, much more minute than those of the small bowel. In the carcinomatous form of the disease, the investing membrane is often remarkably thickened, highly vascular, rough, pulpy, and exceedingly fragile.

It is surprising that polypes should have been supposed by some writers to be destitute of vessels. Such an opinion could only have arisen from the most careless and superficial examination. In many cases the vessels are not only quite apparent, but large, tortuous, and even varicose. The veins evidently predominate, both in volume and number, and their parietes are often so thin and brittle that they are scarcely able to sustain the pressure of the column of the contained blood. The largest usually ramify over the surface of the morbid product, immediately beneath the mucous membrane, to which they frequently impart a beautiful striated appearance. The arteries are comparatively small, and pervade the substance of the tumor in every direction, conveying to it the materials which are required for its growth and nourishment. Both classes of vessels are derived from the structures to which the polype is attached, and not from any formative or creative power of the abnormal body itself, as is the case, for example, with encephaloid. No nerves or absorbents have been detected in these excrescences, but that they exist in them, and are derived in the same manner as the blood-vessels, does not admit of doubt, though we have no means of demonstrating the fact.

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## CHAPTER XVIII.

### OF HYDATIDS.

*Historical Outline.*—Where found.—Classification of Hydatids.—The *Cysticercus*, *Polycephalus*, *Dicercas*, *Echinococcus*, and *Acephalocystis*.—Their Origin and Organization.—The manner in which they are nourished.—The Changes which they experience by Age, and the Alterations they induce in the Organs in which they are developed.

THE combined researches of naturalists and pathologists have shown that many of the higher orders of animals, as well as some of the lower, are infested with a class of beings, which are generally known, at the present day, by the name of hydatids. The account of these singular bodies by the ancients is extremely imperfect; nor did the scanty stock of knowledge which they left us receive much accession until after the middle of the last century. Since that period much light has been thrown upon the history, development, and organization of the different kinds of hydatids, principally by the researches of Rudolphi, Zeder, Laennec, Ludersens, Cuvier, and Cloquet, the latter of whom published a very lucid and elaborate article on the subject, in 1818, in the French Dictionary of the Medical Sciences. Much, however, as these distinguished anatomists have done, it must be confessed that there are a great many interesting circumstances concerning which we are still in complete uncertainty.

Hydatids occur in the serous cavities, the alimentary canal and the passages which open into it, the cellular tissue, among the muscles, and in the proper substance of the different organs. Nevertheless, there are, as will be hereafter seen, some parts that are more frequently affected than others. They have been found in nearly all classes of animals, in birds, reptiles, and fishes, as well as in a great many of the mammalia. Whether they exist in insects, has not been ascertained. No period of life is exempt from them. Portal, indeed, mentions an instance of their having been detected in the fœtus. They are most common, however, in adults and old people.

So far as can be ascertained, these parasitic beings possess no genital organs, no apparatus for respiration, no trace of a circulation, and apparently no nerves. They can live and propagate their species only in the interior of other animals, and their existence is usually very brief, most of them perishing within the first year or two after they are developed, often much earlier. A few of them only are capable of performing distinct movements under the influence of external stimulants. The *cysticercus*, for example, when put in lukewarm water, not only whirls itself about, but alternately protrudes and retracts its suckers. The *acephalocyst*, on the contrary, remains perfectly quiescent, and may therefore be said to be void of irritability and contractility.

In describing these singular animalcules, I shall divide them, with Cloquet and others, into five genera: 1, the *cysticercus*; 2, the *polycephalus*; 3, the *dicercus*; 4, the *echinococcus*; and, 5, the *acephalocystis*. Differing from each other in many essential points, it will be necessary to devote to each of these genera separate consideration. It may be premised, however, concerning them, that they all consist of a thin, pellucid vesicle, varying in size between a clover-seed and an orange, which is filled with a clear, watery fluid, and surrounded by a dense, fibrous capsule, upon which they depend for their nourishment and support.

The *cysticercus* is nearly cylindrical in shape, terminating behind in a caudal vesicle, whence its name. The whole animal is somewhat wrinkled, and its head, which strongly resembles that of the tape-worm, is furnished with hooks and suckers. This genus is more frequently met with in the inferior animals than in man, and is particularly common in the liver and brain of the sheep. Its size rarely exceeds a small walnut, and in most cases it is not near so large. It generally exists singly in the enclosing cyst, which is almost always thin, delicate, and transparent, except in old cases, or where the hydatid has lost its vitality, when it is apt to be thick, dense, semi-cartilaginous, or even bony. In the sheep, in which this genus often acquires a large size, the caudal vesicle presents an infinite number of minute elevated lines, running nearly at right angles with the body of the animal. Five species of the *cysticercus* have been recognized by authors, the cellular, vesicular, dicystic, speckled, and Fischerian.

The *cellular cysticerce* (Figs. 18, 19, and 20) is met with almost exclusively in the hog, in which it occasions the disease commonly known under the name of *measles*, or what the German writers call *finnen*. It has been observed only once or twice in the human subject. The body is conoidal, from four to ten lines in length, and composed of a thin, transparent membrane, without any perceptible fibres: the

Fig. 18.

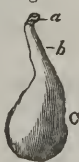


Fig. 19.



Fig. 18 exhibits the natural form of the animal; a, the head; b, the neck, and c, the dilated vesicular tail. Fig. 19 shows the head in a magnified state, d, the proboscis; e, e, e, the sucking discs.



caudal bladder is of an oval shape, and the head, which is tetragonal, is furnished with four suckers, together with thirty-two hooks divided into two rows.

Fig. 20.



A portion of human muscle with the cysticercus enclosed; a, a, the cyst cut open; b, b, the parasite; c, the muscle.

The *vesicular* species (Figs. 21 and 22), which is also very rare in man, having been found only in a single instance in the choroid plexus of an apoplectic subject, has hitherto been chiefly observed in the ox, sheep, swine, goat, stag, and gazelle. The peritonæum, pleura, and arachnoid are the situations in which it delights to dwell. Its head, which is almost tetragonal, is armed with a cylindrical and slightly

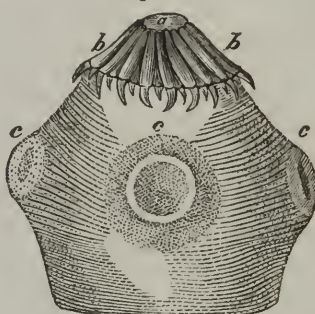
curved snout; the neck is quite short, the body small, and the caudal vesicle nearly spherical.

Fig. 21.



The natural form of the parasite.

Fig. 22.



The head, as it appears under the microscope; a, the flattened promontory; b, b, the hooklets; and c, c, c, the suckers.

The third species (Figs. 23 and 24) is the *dicystis*, or, as this term literally signifies, the double-bladder hydatid. Laennec is the only person who has observed this worm. He found it in the lateral ventricles of a man who had died of apoplexy. It consists of two large vesicles, of which one is caudal, whilst the other, which is annulated and of a conical shape, forms the body. Both are traversed by a wide canal, which terminates anteriorly in a cul-de-sac. The head has four suckers, and a certain but indeterminate number of hooks.

Fig. 23.



Fig. 24.



Fig. 23 is the *dicystis* of the natural size; Fig. 24 the magnified head.

Fig. 25.



Fig. 26.



The *speckled cysticercus* (Fig. 25) has a head with one sucker and six hooks; the body is conical, nearly transparent, and from four to eight lines long; the caudal bladder is spherical and irregularly dotted with very small white points. It has been met with only in one instance, by Treutler, in the choroid plexus of a young woman.

The *Fischerian species* (Fig. 26) has a rounded, slender, annulated body, and a large head furnished with an indeterminate number of hooks and suckers. The caudal bladder, which is pear-shaped, is about the fourth of

an inch long, and terminates in a small point, which adheres to the organ

which the animal inhabits. It is said to have no enclosing cyst. Dr. Fischer, of Leipsic, after whom it is named, detected it twice in the choroid plexus of the human subject.

The second genus, the *polycephalus*, is extremely rare, and has not, up to the present time, so far at least as I am aware, been found in man. It is composed of a semi-transparent cyst, speckled with minute, opaque, whitish spots, and is of a somewhat oval figure; it is generally very small, and is provided, as the derivation of the name indicates, with a great number of heads. The situations which it generally occupies in the inferior animals are the brain, liver, and intermuscular cellular tissue. Two species have been noticed by authors, the *cerebral* and the *granular* (Figs. 27 and 28), which, however, as they never occur in the human subject, need not be described.

The *diceras*, a genus established by Sulzer, infests the alimentary canal of animals, and also occasionally that of the human subject. The German author here mentioned first observed it in the alvine evacuations of a young woman after having taken some purgative medicine. This genus, which embraces only one species, the *rough diceras* (Fig. 29), is distinguished by its flat, oval body, which is about a line and a half long, and terminated in a point posteriorly, and by the rough, bifid horn which surmounts its head, and from which the animal derives its name. It is loosely enclosed by a capsule. As yet it has not been discovered in the substance of any of the viscera. Of the *diceras*, I have never seen any specimens, and suspect it to be very uncommon. Rudolphi, indeed, appears altogether to doubt its existence, whilst others suppose that it is merely a variety of the *acephalocyst*.

The fourth genus (Fig. 30), the *echinococcus*, was first suggested by Rudolphi, but is not admitted by Cuvier. Occurring principally in the brain, liver, spleen, and omentum, it consists of a capsule, analogous in structure to that of the *acephalocyst*, attached to the inner surface of which are numerous animalcules, of an ovoidal shape, extremely fine, granulated, and provided with four suckers and a crown of hooklets. The *echinococcus* is very rarely found in the human subject. Zeder discovered some in the brain of a young woman, occupying the third and fourth ventricles: they were about twelve in number, pyriform, and quite small. Müller has recently described an instance in which they were voided with the urine, by a man labouring under renal disease. But the most extraordinary case, perhaps, on record, is that published by Rendtorf. The sac

Fig. 27.

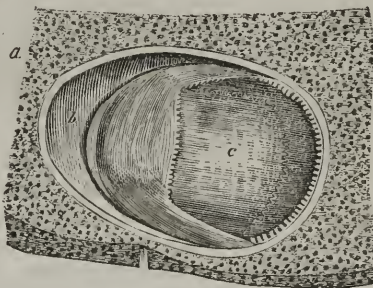


Fig. 27 exhibits the granular polycephalus embedded in the liver of the sheep: *a*, the hepatic tissue; *b*, a portion of the cyst; *c*, the parasite cut open. Fig. 28 is a small body attached to the inner surface of the animal.

Fig. 28.



Fig. 29.



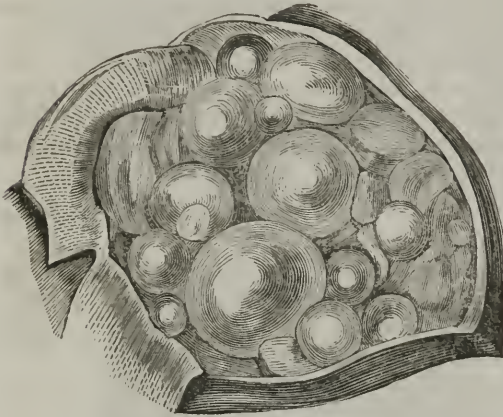
Fig. 30.



containing the hydatids was developed in the brain; it was of a large size, and weighed upwards of two pounds. The walls of the right ventricle, in which it was situated, were so attenuated as to be scarcely a line and a half

in thickness. The name by which this genus is designated, has reference to the rounded form of the body, and to the little asperities on its surface.

Fig. 31.



The fifth genus, the *acephalocystis* (Fig. 31), by far the most interesting and common of all, was founded by Laennec, who published a very accurate account of it, in 1804, in his excellent "Memoir on Vesicular Worms." Occurring both in the human subject and in many of the inferior animals, the individuals of this class of parasites infest some organs much more frequently than others.

They seem to have a remarkable predilection for the liver, owing, probably, to some peculiarity of structure favorable to their development. The brain, ovary, uterus, mammary gland, spleen, and kidney are also sometimes their seat; in fact, they have been found in every part of the body, except the alimentary canal, the urinary bladder, and the respiratory passages.

Varying in size between a mustard-seed and a large orange, they are generally of a spherical figure, and composed of a white, semi-opaque, pulpy vesicle, filled with a clear, limpid fluid. This vesicle, which forms the hydatid, properly so called, is from the sixth of a line to the eighth of an inch in thickness, is often separable into two or more layers, and is so exceedingly delicate as to yield under the slightest pressure of the finger. So weak is it, indeed, that it is frequently incapable of withstanding the pressure even of its own contents, as I have had repeated opportunities of witnessing, after the partial removal of the enclosing cyst. On being ruptured, it shrinks into a soft, irregular, pulpy mass, of an opaline color, which readily swims in water, and bears the greatest resemblance to the white of a hard-boiled egg. M. Collard,\* a French chemist, who has recently examined this substance, states that it consists of two principal ingredients, one of which is essentially albuminous, whilst the other, the precise nature of which is not known, has a considerable analogy with mucus.

Fig. 32.



To the inner surface of the vesicle now described are often attached extremely minute bodies (Fig. 32), not bigger than the finest grain of sand, of a greyish color, and a spherical shape, which are supposed to be young hydatids. In some instances they are connected with the exterior of the parent sac; but this is very rare, and I have never seen an example of it. It has been made the basis, however, of the division of *acephalocysts* into two species, the endogenous and exogenous, the former being

most common in the human subject, the latter in the ox and other ruminant

\* Dict. de Médecine et de Chirurgie Pratiques, art. *Acephalocystis*, p. 196.



animals. In what manner these animalcules originate, how they are attached, or at what time, after their formation, they are cast off, are circumstances in their history concerning which we are ignorant. All that is known with any certainty is, that they may often be seen floating about in great numbers, while they are scarcely the two-hundredth part of an inch in diameter, which would lead us to infer that they are generally detached at a very early period of their existence. When the hydatid, as often happens, consists of several coats, the generation sometimes takes place between them, or even in their substance. In whatever way it is accomplished, a small opaque elevation, easily distinguishable by the eye, usually indicates the spot where the young have been developed.

It sometimes happens, though not very often, that a large acephalocyst contains several that are smaller, one within the other, all of the same shape and structure. As many as three, four, and even five, have been found thus enclosed, like so many pill-boxes. This arrangement, which occurs much oftener in the human subject than in the inferior animals, is explained by the endogenous mode of generation previously adverted to, by which one acephalocyst, after having arrived at maturity, produces another, each successive one being smaller than its parent.

The enclosing cyst of this species of hydatid is usually semi-transparent, very strong and dense, and has no connection whatever with the parasite within. In fact, there is commonly interposed between them a soft, pulpy, dirty-looking substance, arranged in a thin, unequal lamella, which is regarded by Dr. Hodgkin\* as a sort of excrementitious secretion, furnished by the hydatid itself. The thickness of this outer capsule varies a good deal with the size and age of the tumor: it can occasionally be separated into several layers, and may be said to possess all the properties of the fibrous tissue, without any of its linear disposition.

Cruveilhier, who has written an able article on acephalocysts, in the French Dictionary of Practical Medicine and Surgery, divides them into two species, the solitary and the social, a distinction which he appears to regard as of no little importance. The first variety is of most frequent occurrence in animals, and is rarely developed singly, or only in one organ. In the sheep and the ox it has been found simultaneously in the lungs, the spleen, heart, brain, and kidneys. The social hydatid, on the other hand, is most common in man; and seldom coexists in several viscera, or in several parts of the same organ. The structures in which it is most frequently developed are the ovary and uterus, where hundreds, nay thousands, from the volume of a clover-seed to that of the fist, are occasionally found wrapped up by one common pouch. To this division there can be no particular objection, provided it be borne in mind that the distinction rests solely upon the manner in which the hydatids are isolated or grouped together, not upon any difference of form, texture, or organization.

Such is a rapid sketch of the most common genera and species of hydatids. Let us now inquire briefly into their origin and organization, the manner in which they are nourished, the changes they experience from age, and the alterations they induce in the tissues in which they are developed.

With regard to the origin of hydatids all is doubt and conjecture. The idea of Vitet, adopted by Jæger and others, that they are the result of inflammation, although not generally embraced by pathologists, seems, on the whole, less objectionable than any other that has been suggested. This opinion de-

\* Lectures on the Morbid Anat. of the Serous Membranes, p. 137. London, 1836.

rives considerable plausibility from what occurs in the inferior animals. In many ruminants hydatids may be produced, almost at pleasure, by confining them in moist situations and restricting them to very juicy, unripe vegetables. Cruveilhier informs us that, for several years during which he resided at Limoges, in France, comparatively few cattle were killed there that had not acephalocysts in the liver, lungs, or some other organs; and in Cincinnati, where there are annually slaughtered upwards of two hundred thousand hogs, probably not a tenth part are free from this disease. Whole droves, consisting of three or four hundred heads, are sometimes thus affected. These animals, most of which are young, are raised in the prairie districts of Ohio, Indiana and Kentucky, and are literally stuffed with fresh corn for six or eight weeks before they are sent to market. The consequence is, that the portal circle is kept in a state of constant congestion, which finally leads to inflammatory irritation and the development of acephalocysts in the liver and other viscera. The irritation thus set up is of a specific nature, and is followed by the deposition of a fibro-albuminous substance, or, what is the same thing, a sort of plastic lymph, the particles of which arrange themselves in such a manner as to create an inferior being, an entozoic parasite.

Whilst this formative process is going forward, the parasite takes care to isolate itself from the parts in which it is developed, by means of a capsule, which surrounds and protects it from injury. This capsule is supposed, by Dr. Hodgkin and others, to be derived from the circumjacent cellular tissue, an opinion respecting which I feel myself obliged to dissent, as unphilosophical as well as unsupported by facts. Were there no other reason, the circumstance that hydatids are often found where there is almost an entire absence of this substance, would be sufficient to convince any one of its fallacy. Whilst there is a possibility that the opinion may sometimes hold good, it is certain that, in the great majority of cases, the capsule is a new formation, as much so as the parasite itself, both being developed simultaneously out of the same substance, the only difference between them being the manner in which the particles of each are grouped together. This point may be illustrated by what occurs in abscess of the liver. When the matter is deep seated, especially when it is considerable, there is usually an effusion of lymph, by which a sac is formed, provided with all the necessary appurtenances of organization.

This external, adventitious envelope, formed, as we have just seen, out of the plastic lymph of the blood, is furnished with appropriate vessels, as well as, in all probability, with nerves and absorbents. Many of these vessels are of large size, they can be readily injected, and they are spread out in beautiful arbore-scent lines. So far as I have had an opportunity of examining them—and I have often done this in the acephalocyst of the hog—they appear to me to be derived principally from the surrounding textures. Nevertheless, there are certain situations in which they are plainly the result of new formation, as in the ventricles of the brain, the serous sacs, the ovaries, and the uterus. No where can any of their branches be traced from the outer covering into the walls of the hydatid itself. The reverse of this has, I know, been asserted by authors, but without any just foundation.

The proper hydatid contains, as before stated, a thin, aqueous fluid, which, as long as the animal remains healthy, is generally perfectly clear and limpid, like the purest spring-water. Under opposite circumstances, it is frequently turbid and discolored, or it is entirely replaced by purulent matter, blood, or other substance. Be this as it may, the fluid is usually remarkably saline in its taste, possesses little or no odor, and rarely, if ever, coagulates by exposure to heat, or on the addition of alcohol, corrosive sublimate, or the dilute acids.

In several experiments which I made on the contents of some very large acephalocysts of the liver of the hog, heat produced not the slightest change ; and similar results ensued in a trial which I made on a hydatid taken from the same organ of a man forty years old. These results accord with the researches of Marcet, Cruveilhier, and other writers ; and they point out the great resemblance of the fluid in question to that of hydrocephalus, in its want of coagulability, in consequence of the almost total destitution of albumen.

As hydatids, then, do not possess any vessels, so far at least as we can discover, whence is the fluid just mentioned derived, and in what manner are these parasites nourished ? Deeply interesting as these questions are, we must acknowledge our utter inability to give a satisfactory or even a plausible answer to them. Is there any animal, however minute, which furnishes a secretion, and yet is destitute of vessels ? If there be, I must confess I am not acquainted with it : the very idea, it seems to me, involves an absurdity. That the fluid in question is the product of the hydatid itself, no one can doubt, for it could not be derived from any other source ; and, if this be admitted, it is obvious that it must be the result of vascular action. But it may be said that the fluid is secreted by the containing capsule, and that it finds its way into the proper cyst by a sort of endosmose. The only circumstances which at all countenance this supposition, are some experiments performed by Cruveilhier and Mr. Owen, of London, in which, on placing recent acephalocysts in a colored liquid, they found that little streams of it were gradually transmitted through the parasites, so as to mingle with their contents. These researches, however, besides being incomplete, only prove that this phenomenon may take place here as in other parts, without showing that the fluid is thus actually imbibed by the animal in the natural state.

Let us now recur to the question, how are hydatids nourished ? or, rather, whence do they derive the materials necessary for this purpose ? It has been already seen that these entozoa are completely isolated from the tissues in which they are developed by means of a capsule which has no immediate connection with them ; and the inner surface of which, moreover, particularly in the acephalocystic genus, is generally lined by a thin, pulpy, fragile lamella, which adds still further to the insulation. This intervening substance is supposed by Dr. Hodgkin to be a sort of excrementitious secretion from the hydatid itself : I should presume, on the other hand, that it was an important structure, designed to assist in the elaboration of a fluid for nourishing the parasite. This fluid, which is probably of a sero-albuminous character, and is furnished by the vessels of the enclosing capsule, is filtered through the soft, pulpy matter here adverted to, and is finally imbibed by the proper cyst of the hydatid, which it thus enables to live and to execute its humble functions ; those, namely, of secreting a thin, watery liquid, and of propagating its species. Much of all this, of course, is conjectural ; nevertheless, most of the arguments might be sustained by analogy ; and this is the only kind of proof that can be adduced in illustration of an inquiry environed by so many difficulties.

Many hydatids appear to be short-lived. This is especially true of the acephalocysts of some of the inferior animals, as the sheep and swine, in which they are said to be produced in the spring, and to perish the following winter. In others, again, as well as in the human subject, they last for years, and often acquire a large bulk. Their existence is greatly influenced by the nature of the tissues in which they are developed, as well as by their number and size. Not unfrequently an old hydatid is destroyed by its young, which press upon and finally rupture it. In a second series of cases, death comes on without any assignable cause ; the contained fluid gradually disappearing, and the proper



cyst, as well as the enclosing capsule, becoming collapsed, opaque, corrugated, and of a yellowish amber color. In a third series the parasite is attacked with inflammation. When acute, this disease sometimes ends in a species of gangrene; but more generally it leads to suppuration. Of both these terminations I have had occasion to observe a considerable number of instances. In the former case, the fluid is of a turbid appearance, and the cysts, both proper and adventitious, are converted into a soft, brownish mass, which is sometimes quite offensive. In the latter, that is, when the inflammation ends in suppuration, the contained liquid is often entirely absorbed, its place being occupied by a yellowish, gold-colored pus, of a thick, plastic consistence, slightly saline to the taste, and of a faint animal odor. This occurrence is most frequently witnessed, according to my own experience, in old acephalocysts, and in most of the cases that I have examined the internal membrane was either wholly destroyed, or broken up into fragments, mixed with the abnormal secretion.

When the inflammation is of a chronic kind, it is not uncommon for the enclosing capsule to become thickened, indurated, and fibrous, from the deposition of lymph. Occasionally it puts on exactly the appearance of the interior of a large aneurismal sac; cases have also been observed where it was rendered cartilaginous, and even bony. The ossification usually begins by a few central points, which gradually augment in diameter, until, in some instances, they coalesce with each other, and form considerable sized patches.

A hydatid has been known to be the seat of apoplexy. The only instance of this kind that I remember to have read of, is that mentioned by Dr. Hodgkin, in his morbid anatomy of the serous membranes: it occurred in a man forty years old. The hydatid was seated in the neighborhood of the spleen, and was externally of a dark color, which arose from a thin layer of blood interposed between the proper and the enclosing cyst.

Hydatids may prove mischievous in two ways; first, by their great number, and, secondly, by their large size. In either case they are apt, sooner or later, to excite inflammation in the parts in which they are situated, which may terminate in suppuration, softening, gangrene, induration, or, finally, in ulceration. The hardest structures are sometimes incapable of withstanding their progress. Thus, Andral records a case in which they perforated the scapula. When seated in the abdominal viscera, they are often passed by stool, ejected by vomiting, or discharged externally through a fistulous aperture. In the lungs, hundreds are sometimes coughed up by the same patient; in the kidneys they have been known to be voided with the urine, either entirely, or in small fragments. In the brain, they may become a source of epilepsy, paralysis, or destructive softening; and, in the serous cavities, their escape is occasionally attended with fatal inflammation.

I need scarcely allude here to the doctrine of Adams, Baron, and others, that hydatids are essentially connected with the origin of tubercle and carcinoma. This theory, to which I shall particularly advert elsewhere, is founded on the frequent co-existence of these diseases in the cow, sheep, and hog; a circumstance which is very rarely witnessed in the human subject, and which has led to the general abandonment of the views in question.

## CHAPTER XIX.

## OF SEROUS CYSTS.

Have the form of shut Sacs.—Organs in which they are most frequently found.—Classification : the Simple, Multilocular, and the Included.—Nature of the contained Fluid.—Are either new Products, or formed out of the pre-existing Textures.—Are liable to Inflammation and its Consequences.

MUCH more simple in their structure, as well as much less obscure in their mode of origin, than hydatids, are those membranous pouches which have received from morbid anatomists the name of serous cysts. Deriving their generic distinction from their contents, which are usually of an aqueous character, they constitute a class of adventitious textures, which, like those naturally existing in the splanchnic cavities, form perfectly shut sacs, rough and adherent on one surface, smooth and in contact with a fluid on the other. Their shape is globular, ovoidal, pear-like, or pediculated, and in size they observe every intermediate degree between a grain of mustard and a large melon. As far as can be ascertained, they are, with few exceptions, the result of an entirely new formation, dependent upon the effusion and organization of plastic lymph. With the mechanism of this creative process, as with that of hydatids and other accidental growths, we are altogether unacquainted ; nor is it possible always to appreciate the different morbid lesions which precede and accompany it : that it proceeds, however, under the influence of causes which excite inflammation in the normal tissues, is a fact borne out both by observation and analogy.

Like hydatids, with which they are often confounded, serous cysts are found either upon the free surfaces in the natural cavities, or in the proper substance of the organs. They have been observed in almost all classes of animals ; and, although no period of life can be said to be exempt from them, yet they are much more frequently seen in the old than in the young, and, according to my own experience, in the female than in the male. Like hydatids, they may be considered as a species of parasites that live at the expense, and in the interior, of other beings, more perfectly organized than themselves, which afford them protection, and the means of subsistence. Their occurrence is extremely common, both in man and in ruminating animals ; and it has even been contended that they occasionally manifest a hereditary tendency, the greater portion of a large family having been known to be thus affected during several successive generations. They have been found in nearly every structure and cavity of the body, but particularly in the ovaries, the liver, kidneys, the mammæ, and the testicles. They are also not infrequent in the brain of old persons ; but they are seldom seen in the spleen, heart, lungs, and pancreas. In the vessels, the fibrous membranes, ligaments, cartilages, and mucous outlets, they have not, I believe, been noticed.

Viewed in reference to their structure, these adventitious sacs may be divided into three classes, the simple, the multilocular, and the included. Before we proceed to speak of these in detail, it will be proper to offer a few remarks concerning their contents. Like the natural serous membranes, the sacs in question, when once formed, or even whilst they are in progress of development, enjoy a life of their own, and are susceptible of various morbid actions, either set up in their substance or propagated to them from the surrounding normal textures. So long as they remain healthy, or in the exercise of the

functions which nature has assigned to them, the fluid which they secrete, and which occupies their interior, is of a thin, watery consistence, clear and limpid, somewhat saline in its taste, and more or less coagulable by heat, alcohol, and acids. As to quantity, it must vary, of course, according to the size of the morbid growth, in every gradation, from a single drop to many ounces or even quarts. When affected with disease, the contents of the cysts are differently altered, and often present appearances which are not to be observed under similar circumstances in the normal serous textures. The most interesting of these changes will be adverted to in another paragraph.

The *simple cyst*, the type of the whole series, consists of a thin, delicate sac, generally of a globular figure, the interior of which, in the healthy state, is occupied by a pellucid fluid possessing all the properties of the serum of the blood. Composed of a single lamella, it is usually perfectly transparent, seldom bigger than an orange, and is supplied with very long, slender vessels, which are evidently derived, in all cases, from the circumjacent parts. It is from these vessels, which are often extremely numerous, and spread out in the most beautiful arborescent manner, that the cyst obtains its nutriment and the materials from which it prepares its contents. They are accompanied, very probably, by nerves and absorbents; but these, if they exist, are so excessively minute as to elude our closest scrutiny; and hence no anatomist has ever succeeded in tracing them. The parts in which this variety is most frequently developed are the internal organs of reproduction in the female, particularly the ovaries and the fimbriated extremities of the Fallopian tubes, the liver, and the brain, in the lateral ventricles of which, along the choroid plexus of old subjects, they often occur in clusters of ten, twenty, or thirty at a time, the largest not exceeding a common currant.

Advancing a step higher in the scale of complexity, we come to the second division of our subject, the *multilocular cyst*. The principal difference between this and the preceding variety consists in the cellulated structure which is to be found in the former, whilst there is an entire absence of it in the latter. This arrangement, from which the present accidental growth derives its name, is produced by a variable number of membranous processes, which are attached to the inner surface of the main cyst, and extend inward so as to intersect each other in different directions. In this way numerous compartments are formed, varying in size and shape, which sometimes communicate together, at other times are perfectly distinct. The most curious circumstance connected with these chambers is, that they often contain different kinds of substances. Thus, one may be occupied by perfectly limpid serum, a second by pure blood, a third by pus, and a fourth, perhaps, by fatty, melicerous or atheromatous matter. The reason of this cannot be easily explained: we might naturally expect to find it in some difference of structure; but, in the majority of cases, no such difference exists; and we are therefore forced to conclude that the phenomenon depends upon a modification of secretion.

This variety of cyst is most commonly found in the cerebral substance around old apoplectic effusions. It is also frequently seen in ovarian tumors, and in the subcutaneous cellular tissue, in parts which are constantly subjected to pressure, as the shoulders of porters and the knees of chamber-maids. In its shape, the multilocular cyst is generally irregular, its walls are of unequal thickness, and its internal processes are often rough and uneven.

The third variety, much less frequent than either of the others, is characterized by the circumstance of the main cyst, which is commonly of an irregular shape, containing ulcers of smaller ones attached to different points of its



inner surface. The number of included vesicles is sometimes truly surprising, many hundreds being found in the same specimen, from the volume of a grain of mustard to that of a hickory-nut; they are mostly of a globular form, and are composed each of a single lamella, which is continuous with, and appears to be merely a reflection from, the original sac, which not unfrequently contains several series of these junior cysts. On cutting into them, they are found to be occupied, in the great majority of instances, by a serous fluid, in others by a matter resembling the white of eggs, thin starch, or a solution of gum arabic; or all these substances may occur at the same time, filling different cavities. When the interior vesicles are large or numerous, they sometimes completely distend the main cyst, rendering it rough and protuberant, and occasionally even bursting it; after which, being no longer repressed, they often grow with extraordinary rapidity.

These cysts, which I shall denominate the *included*, are apt to be confounded with hydatids; but may be readily distinguished by the fact of their being all intimately connected with the parent sac, and by the circumstance of vessels passing from the one to the other. The parts in which these cysts are most frequently met with, and in which they acquire the largest size, are the ovaries and the broad ligaments of the uterus. In most cases, as was previously stated, they are of a globular form; but it is by no means unusual for them to present a pediculated appearance, especially the binary and tertiary orders.

Thus, there are three distinct varieties of serous cysts, all referable to three general modes of formation, the first being the most simple, the third the most complicated, the other being intermediate between them. In other words, the first consists of a simple sac, filled with a serous fluid; the second, of a sac which is intersected by more or less numerous processes; and the third, of a sac which contains clusters of smaller ones, precisely of the same shape and structure with itself.

It will be recollected that these different classes of cysts are the result, in most instances, of an entirely new formation, dependent upon a perverted state of the nutritive function. In other cases, they appear to be formed out of pre-existing textures, sometimes of a serous, at other times of a mucous nature. To the former category belong the cysts, which are so often found in the ovaries, in consequence of the enlargement of the vesicles of De Graaf; to the latter, those which are developed in the kidneys and in the female breasts, from obstruction of the excretory ducts. In these situations it is not uncommon for the adventitious growth to receive an accidental covering from the organ in which it is located. In the ovaries, for example, we accordingly find that the cyst is usually provided with very thick, dense parietes, separable into three distinct layers, the internal of which consists of the capsule of the vesicle of De Graaf, the second of the albugineous, and the third of the peritonæal coat of the organ. The same thing is sometimes observed in the spleen and liver. It is worthy of remark that, when the cyst is formed out of pre-existing mucous membrane, as in the instances above referred to, it generally, in the course of a short period, assumes all the properties of the serous textures.

Serous cysts, whether of new formation, or constructed out of the pre-existing tissues, are liable to inflammation, and, when thus affected, they may present all the phenomena which characterize this disease in other parts of the body. The contained fluid, in such cases, is generally thick, turbid, and discolored, owing to the presence of substances which do not naturally belong to it. Occasionally, it has the aspect and consistence of coffee-grounds, thin treacle, or tar; and the instances are by no means unusual in which it possesses all the

properties of genuine pus. A fatty matter has also been found in it, as well as a substance resembling cholesterine. The cyst itself may be variously affected. Generally speaking, it is opaque, greyish, dense, and fibrous, being thicker and stronger at some points than at others. The examples, I believe, are rare in which the cyst is eroded, or transformed into cartilage or bone. The alterations which it creates in the parts where it is situated need not be particularly described, as they do not differ from those induced by hydatids.

## CHAPTER XX.

### OF THE HETEROLOGOUS FORMATIONS.

Preliminary Observations. — Classification: Tubercle; Melanosis; Scirrhus; Encephaloid; Colloid — I. *Tubercle*. — Definition. — Great frequency. — Occurs nearly in all Tissues, and at all Periods of Life. — Is common in the lower Animals. — Chemical Composition. — Varieties of Form. — Concrete and semi-concrete Tubercular Matter. — Notions respecting its Origin, Development, and Organization. — Softening and Excavations. — II. *Melanosis*. — Historical Sketch. — Occurs in Man and Animals. — Chemical Analysis. — Color and Consistence. — Varieties of Form. — Tissues most liable to suffer from Melanotic Diathesis. — States of the System which predispose to its formation. — III. *Scirrhus*. — Difficulty of the Subject. — Definition. — Varieties of Form. — Chemical Constitution. — Rarely appears before the age of thirty. — Most common in Glandular Organs. — Proximate Cause. — Opinions of Adams, Carmichael, Hodgkin, and others. — Is apt to Ulcerate and involve the general System. — IV. *Encephaloid*. — Is intimately allied to Scirrhus. — Terms by which it has been designated. — More frequent in some Structures than in others. — Varieties of Form. — Color, Consistence, and Composition. — Organization and Mode of Origin. — A Disease of early Life. — Involves the whole System. — Termination. — V. *Colloid*. — First described by Laennec. — Different names. — Is a distinct Formation. — Composed of two Elements. — Microscopical Characters. — Cellular Tissue, Vessels, and Nerves. — Chemical Constitution. — Varieties of Form. — Most common Situation. — Most frequent from Thirty-five to Fifty. — Mode of Origin and Progress.

By the term heterologous are understood certain morbid products, of a solid or semi-concrete consistence, which have no resemblance whatever, or, at most, only a very remote one, to the natural, normal, or pre-existing tissues of the body. It is of Greek derivation, literally signifying unlike, dissimilar, or without analogy, and is employed by many as synonymous with the word heteroclite, first devised, I believe, by some of the German anatomists.

The number of heterologous products has been variously stated by writers, but it admits of much doubt, whether there are really more than five, namely, the tubercular, the scirrhus, the encephaloid, the colloid, and the melanotic. To these might, perhaps, be added the parasitic animals which are developed in different parts of the body, such as worms and hydatids, and the calcareous concretions which are found in certain cavities and canals, as in the urinary bladder, the ureters, the intestinal tube, and in the veins. Cirrhosis, sclerosis, and some other morbid appearances, comprised under the present head by Laennec and Beclard, are evidently foreign to it, and must therefore be excluded. Any arrangement, however, that may be offered in the present state of the science must, from the very nature of the subject, be imperfect, and susceptible of further improvement. Indeed, I am not certain that the term heterologous, as applied to these formations, is not altogether ill-chosen, and out of place, since most of them are found, when carefully investigated, to have a very close resemblance, in many of their most essential features, to the normal tissues of the body. Thus, encephaloid bears a striking

similitude to the substance of the brain; melanosis, to the coloring matter of the skin; scirrhus, to the dermoid texture; tubercle, at least in some of its forms, to fibro-cartilage; and colloid, to the vitreous humor of the eye. But these are topics, concerning which, as we have no positive information, it would be idle to speculate.

Although the heterologous formations, properly so called, are not of equal frequency, yet they all have one common tendency, namely, to destroy, sooner or later, the structures in which they are located. Hence the propriety of the term malignant, under which some of them have long been noticed by authors, and from which arrangement, from some unaccountable circumstance, tubercle has hitherto been excluded. Not only, indeed, is this disease malignant, but, if we reflect upon the rapidity of its progress, and its extraordinary fatality, it must unquestionably be regarded as the most malignant of all the heteroclite formations of which we have any knowledge. The period during which the morbid deposits remain, varies from a few months to several years; a circumstance which, together with the several changes which they themselves undergo, and which they exert upon the structures in which they are located, will be fully adverted to in the following sections.

These morbid products occur at all periods of life, in both sexes, and in nearly all the organs and tissues of the body. Their origin, although still enveloped in obscurity, is probably of an inflammatory nature, attended with an aberration of the nutritive function, and the deposition of a new substance unlike any other in the organism.

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## SECTION I.

### TUBERCLE.

Of all the heterologous formations, the most interesting, unquestionably, is the tubercular, whether it be viewed in reference to its frequency, the obscurity which still envelopes its nature, or the great attention which it has always elicited from the medical philosopher. Occurring at all periods of life, from the most tender infancy to the most decrepid old age, it is the cause, in all probability, of nearly one third\* of all the deaths that annually happen throughout the world. If this be true, as the data which we have, though still very imperfect, would lead us to infer, it will be readily granted that a knowledge of this disease must be of vast importance to the practitioner, and worthy of his most profound investigation.

What is a tubercle? A correct answer to this question must, it is obvious, be a matter of no little moment at the very outset of this branch of the subject. The term tubercle was anciently applied, in a very vague manner, to almost every kind of tumor, no matter what was its situation, form, consistence, or composition. The confusion concerning the character of this and other morbid products, thus introduced in the infancy of the science, prevailed during more than twenty centuries, and is still, there is reason to believe, sufficiently common. The definitions which have been given of this term are almost as numerous as the authors who have written upon the disease. It is of Latin derivation, and literally implies a little swelling. In the sense in which I

\* The greater part of this mortality is caused directly by pulmonary phthisis; the rest by tubercles of the lymphatic ganglions, the spleen, the serous membranes, and the bones.



shall here use it, it denotes a small, solid tumor, of an irregularly spherical figure, more or less opaque, of a pale yellowish color, seldom exceeding the volume of a pea, susceptible of organization, and composed of a peculiar substance, which, sooner or later, undergoes a process of decomposition. This definition, however, does not embrace more than two of the varieties of form in which the tubercular matter is deposited; and it is rather in compliance with the established custom of pathological writers, than the rules of sound criticism, that I restrict the meaning of the word within these narrow limits.

There is hardly an organ in the body in which tubercular matter is not occasionally deposited. Nevertheless, it is much more common in some situations than in others. The lungs, lymphatic ganglions, the spleen, peritonæum, the mucous follicles of the alimentary canal, the liver, the spongy texture of the bones, and the adventitious membranes of the splanchnic cavities, are particularly distinguished by the frequency with which this disease originates in them. Of these parts, again, the summits of the lungs and the lymphatic ganglions, especially the bronchial and mesenteric, are most liable to suffer; for the reason, probably, that they naturally possess a very languid circulation, and are therefore proportionably prone to inflammatory congestion.

It would appear, from the researches of some of the European pathologists, as Louis, Lombard, Andral, and Papavoine, that the *site* of tubercular disease is influenced, in a very considerable degree, by the age of the individual. This is a circumstance which, from its practical bearing, is deserving of further attention. The three following tables afford an account of the localization of this heterologous deposit in children and in adults. The first is constructed from the excellent memoir of Dr. Lombard, of Geneva, and is founded on one hundred careful autopsic inspections.

TABLE I.

Bronchial ganglions	-	-	-	-	-	87 times.
Lungs -	-	-	-	-	-	73 "
Mesenteric ganglions	-	-	-	-	-	31 "
Spleen	-	-	-	-	-	25 "
Kidneys	-	-	-	-	-	11 "
Intestines	-	-	-	-	-	9 "
Nervous centres	-	-	-	-	-	9 "
Cervical ganglions	-	-	-	-	-	7 "
Cerebral envelopes	-	-	-	-	-	6 "
Pancreas	-	-	-	-	-	5 "
Gastro-hepatic ganglion	-	-	-	-	-	5 "
Subperitonæal cellular tissue	-	-	-	-	-	5 "
Inguinal ganglions	-	-	-	-	-	3 "
Subpleural cellular substance	-	-	-	-	-	2 "
Lumbar ganglions	-	-	-	-	-	1 "
Urinary bladder	-	-	-	-	-	1 "
Omentum	-	-	-	-	-	1 "
Gall-bladder	-	-	-	-	-	1 "
False membranes of the pleura	-	-	-	-	-	1 "

The second table is by Rilliet and Barthez,\* and shows the comparative

\* *Traité des Maladies des Enfants*, t. iii.

frequency of tubercular deposits in different organs, in three hundred and fourteen children between the first and fifteenth year.

TABLE II.

Lungs	-	-	-	-	-	in 265 cases.
Bronchial ganglions	-	-	-	-	-	249 "
Mesenteric ganglions	-	-	-	-	-	144 "
Small intestines	-	-	-	-	-	134 "
Pleura	-	-	-	-	-	109 "
Spleen	-	-	-	-	-	107 "
Peritonæum	-	-	-	-	-	86 "
Liver	-	-	-	-	-	71 "
Large intestines	-	-	-	-	-	60 "
Membranes of the brain	-	-	-	-	-	52 "
Kidneys	-	-	-	-	-	49 "
Brain	-	-	-	-	-	37 "
Stomach	-	-	-	-	-	21 "
Pericardium and heart	-	-	-	-	-	10 "

The third table is compiled from the treatise of Dr. Louis, of Paris, and refers to 358 cases of tubercular disease after the age of fifteen. A comparison of this with the materials furnished by Dr. Lombard and by Rilliet and Barthez, will show the occurrence of the morbid deposit in different organs in the *two* periods of life.

TABLE III.

Lungs	-	-	-	-	357, or in all except 1
Small intestines	-	-	-	about	$\frac{1}{3}$
Large bowel	-	-	-	"	$\frac{1}{9}$
Mesenteric ganglions	-	-	-	"	$\frac{1}{4}$
Cervical ganglions	-	-	-	"	$\frac{1}{10}$
Lumbar ganglions	-	-	-	-	$\frac{1}{12}$
Prostate gland	-	-	-	-	$\frac{1}{13}$
Spleen	-	-	-	-	$\frac{1}{14}$
Ovaries	-	-	-	-	$\frac{2}{10}$
Kidneys	-	-	-	-	$\frac{1}{40}$

In the above cases, the uterus was affected only once, the brain twice, the ureter once, the liver twice, and the supra-renal capsules twice.

The inference deducible from these tables is, first, that, in children, tubercles not unfrequently occur in different parts of the body, without existing in the lungs; secondly, that they are more liable to affect the lymphatic ganglions than in adults; and, thirdly, that they have a tendency to attack a much greater number of organs simultaneously or successively. It is a singular circumstance that the spleen is seldom tuberculized in adults, whilst it is very often affected in children, in the proportion nearly of one to four. From the tables of Louis and Lombard, but particularly from that of the latter, it would appear that the liver is remarkably exempt from this disease at all periods of life; a result which is, however, strikingly at variance with the statement of Rilliet and Barthez, who found this organ affected seventy-one times in three

hundred and fourteen cases. Paparvoine observed the liver tuberculized in more than one-fourth of his autopsies, or in fourteen children out of fifty. The intestines are affected with nearly equal frequency at both periods of life.

The time of life most liable to tubercle is between twenty and forty. No age, however, is exempt from it, and it occasionally exists as an intra-uterine malady. Chaussier has related several cases of miliary tubercles in the lungs of the fœtus; and, more recently, similar examples have been published by Billard, Denis, Veron, Langstaff, and Husson. In one of the cases given by the latter, the infant was still-born at the seventh month, and the tubercles, seated in the pulmonary tissue, were in a softened state. In three instances mentioned by Billard, the deposit occurred, in one, in the peritonæum, in two, in the mesenteric ganglions. Dr. Morton, of Philadelphia, has also met with this disease at a very early age. A few years ago my friend, Dr. Rives, of Cincinnati, examined the lungs of an infant six weeks old, and found them crowded with miliary tubercles, many of them in a state of suppuration. I have myself twice observed this disease in children under three months of age, and under circumstances which rendered it almost certain that the heteroclite matter had been deposited either before or immediately after birth. On the whole, however, there is sufficient ground for concluding that tubercles are of comparatively rare occurrence in the fœtus, since, in many hundred dissections of new-born infants made in Paris, by Breschet, Guizot, and Velpeau, these bodies were not seen in a single instance. Rilliet and Barthez find that in children this disease is most frequent from six to ten years and a half, then from eleven to fifteen, next from two to five, and lastly from one to two and a half. Louis, as already stated, has ascertained, from the analysis and comparison of 358 cases, that after the age of fifteen tubercles never occur in any organ in the body, unless they also exist in the lungs. To this statement, which may be regarded as a law, there are, of course, exceptions, but they are too few to affect its general accuracy. Another law, the universality of which is nearly equal to that just mentioned, is, that in children tubercles are secreted more rapidly and in greater abundance than in adults.

Tubercles are not peculiar to the human race. They have been observed in many species of animals, in birds, reptiles, and even in insects; though, as respects the latter, facts are still wanting to illustrate the subject. Amongst quadrupeds they have been noticed in the ape and monkey, the horse, ox, elk, deer, and antelope, the dromedary, sheep, goat, hog, bear, lynx, dog, lion, tiger, cat, squirrel, and rabbit; amongst birds, in several species of macaws and parrots, the turkey, hen, sparrow, and flamingo; amongst reptiles, in the serpent, frog, and turtle.\* In all these various classes of beings, the morbid deposit presents the closest analogy to that observed in the human subject, and is likewise more frequently seen in the lungs than in any other organ. Nor is it limited to any particular period of life. It is very frequently witnessed in the youngest animals, and Dupuy has even met with it in the fœtus of the sheep and rabbit. In lambs, from two to five months old, I have often seen the liver and lungs crowded with miliary tubercles.

It is a singular fact, and one not without its value in a practical point of view, that most of the wild and domesticated animals become affected with tubercles after a certain period of their confinement. Many of the quadrupeds that are imported into this country, and exhibited in our menageries, die from this cause. The dairy cows of Paris and other large cities of Europe, deprived of all exercise, and incessantly pent up in sheds, are extremely liable to suffer

\* Clark on Consumption and Scrofula, p. 212. London, 1838.



from this disease in various organs. Tubercles may be produced at pleasure in animals simply by shutting them out from the open air, by making them breathe a damp, unwholesome atmosphere, and by feeding them on indigestible, deficient, or innutritious aliment. Jenner, Baron, and Carswell induced the disease in this way in a few weeks in the lungs and liver of the rabbit.

The *composition* of tubercular matter has been studied by Thenard, Dulong, Lombard, Lassaigne, Preuss, Hecht, and others, but with no very satisfactory results. In fact, the greatest contrariety of opinion still prevails on the subject. The following quantitative analysis of one hundred and twelve grains of dense tubercular matter is by Dr. Hecht,\* of Strasburgh:

Albumen	-	-	-	-	-	26
Gelatine	-	-	-	-	-	22
Fibrin	-	-	-	-	-	34
Water	-	-	-	-	-	30
						<hr/> 112

Thenard found one hundred parts of crude tubercular matter to consist of—

Albumen	-	-	-	-	-	98
Muriate of soda	-	-	-	-	-	0.15
Phosphate of lime	}	-	-	-	-	1.85
Carbonate of lime		-	-	-	-	
Oxide of iron, a trace.						<hr/> 100

Lombard discovered in crude tubercle ninety-eight parts of animal matter, and only two parts of salts. Chalky tubercle, on the contrary, contained ninety-six parts of salts, and scarcely four of animal matter. These results have been confirmed by the analysis of L'Heritier, who found in hardened tubercle from five to nine per cent. of animal substance, and from ninety-one to ninety-five of carbonate and phosphate of lime.

The discrepancies in the results of the above analyses may be accounted for by supposing that the chemical constitution of tubercular matter varies, as no doubt it does, not only in the different stages of its existence, but also in different individuals, in different situations, and in different parts even of the same organ. It is reasonable to conclude, also, that it is modified, more or less, by the state of the solids and fluids, or, in other words, by the cachexy, or constitutional peculiarity leading to its formation. In all these respects tubercular matter bears the closest resemblance to serum, lymph, and pus, which are often remarkably altered in their chemical and physical properties by the nature of the affected tissue, the state of the system, and the concomitant inflammation. In the inferior animals, the composition of this substance presents, perhaps, still greater variety than in the human subject. In the ox, there is always an unusual predominance of earthy salts, and hence the extraordinary brittleness which characterizes the morbid product. In the turtle I have seen the tubercular substance of the color and consistence of calcareous moss, or what, in mineralogical language, is termed tufa. In the sheep, horse, and some other quadrupeds, on the contrary, the animal matter is generally much greater than the saline, especially in the early stage of the disease.

\* Lobstein, *Traité d'Anatomie, Pathologique*, t. i., p. 378.

Tubercular matter may be deposited upon the free surface of the different membranes, both natural and adventitious, in the cellular tissue, and in the parenchymatous substance of the various organs. In the lungs it manifests a decided predilection for the mucous texture, and hence it is much more frequently witnessed in the air-cells than in the connecting cellular tissue. In the lymphatic ganglions, where tubercular disease is nearly as common as in the lungs, it is always deposited in the interstitial substance. In the liver and kidney the matter may occur upon the surface of these organs, or in their interior; in the former case it is developed in the parenchymatous texture, in the latter generally in the mucous lining of the excretory canals. In the brain, where there is scarcely any cellular tissue in a free state, the heteroclitic substance is deposited in the inter-fibrillar texture. Carswell states that in whatever organ this matter is deposited, the mucous system, if constituting a part of that organ, is, in general, either the exclusive seat of the morbid product, or is far more extensively affected with it than any of the other tissues of the same part. Of the correctness of this opinion there can be no doubt. Cruveilhier has been led to conclude from his researches that tubercle is originally deposited in the ultimate venous radicles, and that, like many other lesions, it is a product of a capillary phlebitis.

Tubercular matter may present itself under four distinct varieties of form, the miliary, encysted, infiltrated, and lamellated. Of these the first and last are the most frequent, both in man and in the inferior animals, and they all depend, it is obvious, upon the condition of the organs and tissues in which they are developed.

The *miliary* variety, so called from its resemblance to a millet-seed, is by far the most common of all, and is the one from which the deposit derives its distinctive name. (Pl. I., Fig. 1.) It is usually of a rounded shape, but may be more or less flattened, ovoidal, or angular, according to the degree of compression exerted upon it by the parts in which it is situated. In its volume it varies from a pin-head to that of a pea. In the brain and liver it is sometimes as large as a cherry, a marble, or even a billiard-ball. It is opaque, inelastic, and of a pale yellowish color, either uniformly, or lighter at some points than at others. In rare instances, it is greyish, reddish, deep-brown, blackish, speckled, bluish, opaline, or of a whitish pearly tint. Its consistence also is liable to much diversity. Thus it may be hard and dense like fibro-cartilage, caseiform, or curdy and friable like cheese, soft, and almost semi-liquid.

The number of miliary tubercles is from one to many thousand. In their early state they are perfectly isolated; but, as they augment in volume and number, they gradually approach each other, and ultimately coalesce, resembling in this particular the pustules of confluent small-pox. In this manner large masses are frequently formed, varying in density from the consistence of recent lymph to that of fibro-cartilage, and presenting an ovoidal, globular, polygonal, or stellated configuration. Tumors of this description seldom exceed the dimensions of a walnut; but they may attain the bulk of an orange, the fist, or even of a fœtal head. This variety of the tubercular deposit, although most common in the lungs and lymphatic ganglions, is often observed in other organs, especially the spleen, the serous membranes, the isolated follicles, the Peyerian glands, the kidney, and the liver. It also occurs in the spongy tissue of the bones, in the brain, testicle, prostate gland, pancreas, thymus gland, the uterus and ovaries.

The miliary tubercle is occasionally surrounded by a distinct capsule, constituting the *encysted* variety of Bayle. (Pl. I., Fig. 2.) The envelope varies very much in its structure and appearance in different cases. On the peritonæum it







Plate I.

Fig. 1. Miliary v.



Fig. 3. Infiltrated v.

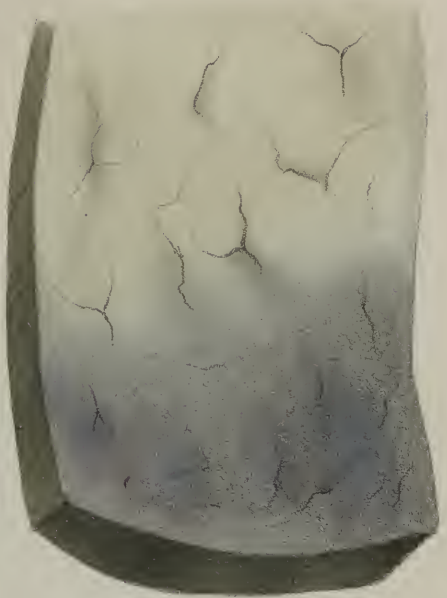


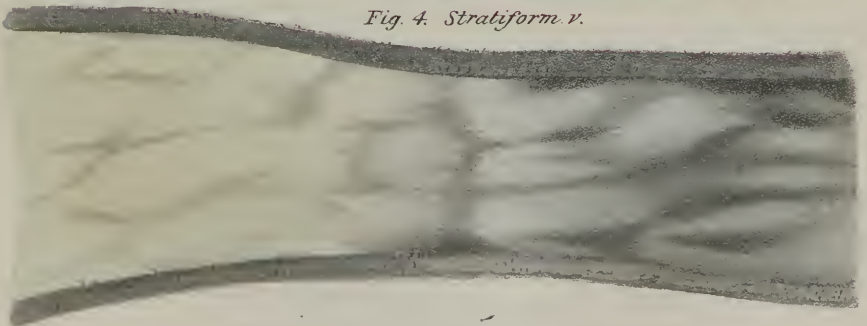
Fig. 5. Grey granulation



Fig. 2.  
Encysted v.



Fig. 4. Stratiform v.







generally presents itself in the form of a thin, transparent film, of excessive tenuity; more commonly, however, it is of a dense, fibrous nature, from the sixth of a line to a line in thickness, and of a pale greyish color; sometimes pink, violet, or mottled. Externally it is firmly attached to the parts in which it is developed, and from which it is often separated with difficulty. The tubercular matter itself is commonly of a greyish yellow tint, opaque, interspersed with dark points, and closely adherent to the inner surface of the cyst. Both structures have probably a cotemporaneous origin. This, however, is still a mooted question. In old tubercles the cyst is sometimes ossified, either wholly, or in part. Bayle alludes to a case of this kind, and a similar one is described by Laennec.

This variety of tubercle is very rare. Louis has seen only a solitary instance; and Carswell appears altogether to doubt its occurrence. Laennec also met with it only a few times; and thus far, although I have made numerous examinations of persons who have died of this malady, I have not seen more than five or six well-marked examples of it. The situations in which it is most commonly found are the peritonæum, lungs, spleen, brain, bronchial lymphatic ganglions, and bones. According to Meckel — the encysted variety of tubercle is most frequent in the inferior animals, as the monkey, dog, and antelope.\*

A third variety of tubercular matter exists in the form of *infiltration*. (Pl. I., Fig. 3.) It is often found around tubercular excavations, sometimes in considerable patches, of a greyish or yellowish appearance, more or less dense, crisp, and firm, like cartilage. In its texture it is apparently homogeneous, presenting, when divided, a smooth, polished surface, in which it is impossible to discern the slightest trace of the original structure. The deposit has occasionally the aspect and consistence of jelly, and then constitutes the *gelatiniform infiltration* of Laennec. This form of the tubercular secretion is exceedingly rare, and is principally observed in the lungs in connection with miliary tubercles, the intervals of which it occupies. The heteroclite matter is of a pale reddish, or greyish tint, verging on greenish. In its consistence it varies according to the period at which it is inspected; at first it is soft, semi-concrete, and almost tremulous; but at a more advanced stage it has the density and solidity of fibro-cartilage, or of a grey granulation. After an indefinite time both the gelatiniform and the ordinary infiltration experience the same transmutations as the common miliary tubercle, the commencement of the degenerating process being announced by the formation of one or more opaque, yellowish points in the interior of the morbid mass.

The fourth variety is the *stratiform*, in which, as the name imports, the tubercular matter is deposited in the form of a layer, generally upon the free surface of the mucous membranes. (Pl. I., Fig. 4.) Next to the miliary variety, this seems to be the most common in which this substance presents itself. It is occasionally met with in the bronchial tubes, but much oftener in the ureter and pelvis of the kidney, the uterus, and the seminal vesicles. The yellowish patches, so frequently found in the coats of the arteries, and described by writers under the name of the atheromatous degeneration, are probably nothing but stratiform deposits of this kind. The layer varies in thickness from that of a sheet of paper to a line, a quarter of an inch, or even half an inch, according to the capacity of the canal or reservoir in which it is situated. It is opaque, curdy, friable, and of a greyish, cineritious, or yellowish tint; it is generally very easily detached from the surface on which it lies, and seems to possess little or no plastic force. It is, in fact, essentially an effete, or excremen-

itial substance. When the matter is poured into the seminal vesicles, the uterus, ureter, or pelvis of the kidney, the lamellated arrangement is only well-marked so long as the deposit is scanty; as soon as it becomes abundant, it assumes an amorphous, nodulated form, and may completely fill the containing cavity. The same arrangement occurs in the bronchial tubes, where the matter sometimes extends into the air-cells, and thus forms small cauliflower-shaped expansions.

This variety of the tubercular deposit is not peculiar to the human subject. It has been repeatedly observed in the lower animals, as the cow, sheep, and rabbit, and I have myself seen it in the green turtle. The new substance, in this instance, occupied the bronchial canals, and was arranged in long, cylindrical masses, and in thin, yellowish patches, of an irregular shape, and from five or six lines to several inches in diameter. In some of the tubes it was firm, tenacious, and separated with difficulty from the mucous surface; in others, it was remarkably brittle, dry, putty-like, and apparently unadherent. Many of the air-vesicles were entirely filled with it.

There is a form of miliary tubercle, which has attracted much notice, and deserves attention both on account of its frequency and the obscurity which still envelopes its origin. The first description of it was given by Bayle, in his "*Recherches sur la Phthisie Pulmonaire*," under the name of *grey granulation*. (Pl. I., Fig. 5.) It is of a dense, fibro-cartilaginous texture, greyish, or colorless, semi-transparent, rounded, ovoidal, or flattened, and from the size of a small pin-head or millet-seed to that of a currant, a pea, or a common cherry. When divided, it is perfectly homogeneous, and exhibits an opaline, shining, or vitreous appearance. It is sometimes invested by a delicate film-like cyst, and always greatly resembles, when first deposited, a globule or small mass of lymph.

The number of greyish granulations varies exceedingly. There may be only a few, perhaps, indeed, not more than one or two, or there may be hundreds, thousands, nay, myriads, according to the size of the affected organ. There is, in fact, no limit in this respect. It is seldom that these little bodies coalesce, unless they exist in vast numbers, when they may unite, and form masses or nodules, equal, in some instances, in volume to a hen's egg, or even to a large apple. Whether isolated, or grouped, they always adhere with considerable pertinacity to the tissues immediately around them, and are frequently encircled by clusters of red vessels, some of which occasionally extend into their substance. After they have existed for an indefinite period, they generally lose their greyish, opaline tint, and assume the appearance of common tubercles. The change usually begins in the centre, in the form of an opaque, yellowish point, which progressively increases until the whole body is completely softened, or converted into a curdy, friable substance, not unlike semi-concrete cheese.

The grey granulation is most commonly met with in the lungs, and on the free surfaces of the serous membranes, both natural and adventitious. It also occurs, and that with considerable frequency, in the mucous follicles of the alimentary canal, in the glands of Peyer, in the larynx and trachea, in the spleen, liver, kidney, and brain. Nelaton has attested its existence in the bones; Papavoine, in the lymphatic ganglions. It occasionally forms with great rapidity, especially in the brain and arachnoid membrane, where the resultant irritation may prove fatal in two or three weeks. In the peritonæum, hundreds may be developed in a few days, from the volume of the smallest pin-head to that of a millet-seed. They may occur alone, or, as is almost always the case, be associated with the yellow miliary tubercle. So constant, in fact, is this coexistence that it may be assumed as a law, liable to few exceptions. In three hundred and fifty-eight subjects, Louis met with

only five examples of granulations without yellow tubercles, and two of tubercles without granulations.

Respecting the true character of this little body, pathologists are not agreed. Bayle regards it as of a cartilaginous nature, different from genuine tubercle, and he has hence made it the basis of a distinct division of pulmonary phthisis. This opinion has been adopted, with some restrictions, by Chomel and Andral. The latter maintains that, when seated in the pulmonary tissues, the grey granulations are merely indurated and enlarged air-cells, filled with inflammatory products, and constituting, therefore, one of the anatomical forms of pneumonia. He has constantly found them in this situation to be soft and red before they become hard and grey. The granulations of the mucous tissues he considers to be nothing more than hypertrophied follicles, and those of the serous tissues the rudiments of adventitious membranes. Laennec regards granulations not as accidental formations, but as nascent tubercles; an opinion in which he is joined by Louis and Rokitsky, two of the highest authorities on the subject of the present day.

To me the grey granulation seems to be merely a variety of the common tubercle, modified by the action of the affected part, the state of the blood, and the condition of the general health. Serum, lymph, and pus are modified in this manner, and why should not tubercle be? To maintain that the grey granulation is merely a nascent tubercle, is, to say the least, not very philosophical. That it is liable to be transformed into the common yellow tubercle is certain, but that death may, and often does take place, before any such change is effected, is equally true. The grey granulation may precede the yellow tubercle, or it may be deposited simultaneously with it. Under whatever circumstances it is found, it always contains a disproportionate quantity of animal matter, and is endowed with much greater power of resisting the influence of such agents as have a tendency to destroy it. It is evidently the product of a more healthy action; it indicates a better state of the solids and fluids; in a word, it is a more plastic, organizable substance than common tubercle.

When first effused tubercular matter is perfectly soft, fluid, or semi-liquid. By degrees, however, as its more attenuated particles are removed, as they always promptly are by the absorbent vessels of the surrounding tissues, it becomes dryer, denser, more opaque, and more solid, and may ultimately acquire the consistence of fibro-cartilage. This constitutes the second stage of the disease, or that of crude tubercle. The period required for this change has not been ascertained. The probability is that it is short. In acute phthisis the tubercles may reach their full development in three or four weeks; and, in the peritonæum, there is reason to believe that they often attain this stage much sooner.

The question as to whether tubercular matter is originally deposited in a fluid or concrete state, need hardly be discussed in the present state of the science. All modern pathologists are agreed that it is soft in the first instance, and that, as we have just seen, it becomes solid only by the abstraction of its serous particles. If we assume that this substance is merely a variety of lymph, as its chemical and physical properties would seem to show, it is, in fact, difficult to conceive how it can be deposited in any other form. Where, for example, is there an instance in which the fibrin of the blood is eliminated in a concrete state? Do we find it thus poured out in the inflammations of the serous membranes? Is it thus deposited upon the interior of the larynx, the trachea, and bronchial tubes, the interior of the uterus, or the alimentary canal, between the edges of a recent wound, or around the fragments of a broken bone? Certainly it is not. But this is not all. In



some parts of the body, as, for example, in the peritonæum, we can detect nature, as it were, in the very act of her work, and distinctly trace this substance as it passes from the fluid to the solid state. In chronic inflammation of this membrane, I have repeatedly seen tubercles in every possible stage of development; some — evidently deposited only a day or two before the individual expired — being soft, viscid, and perfectly transparent; others semi-concrete, yellowish, and consequently more or less opake; and, lastly, another set perfectly dense and firm, like fibro-cartilage, organized, and covered by an accidental serous membrane, of the most delicate texture. Thus, the conclusion is obvious, that all tubercular matter, whatever be its form, site, or extent, is, in the first instance, of a liquid nature, and that it becomes solid, concrete, or crude only by the removal of the serosity which is always poured out along with it.

It has been a subject of speculation how a tubercle, originally not larger than a pin's head, may increase to the size of a pea, a cherry, or even a small apple. Two hypotheses have been framed to account for this phenomenon. One, suggested by Bayle, and adopted by Laennec, supposes that the heteroclitic body grows by eccentric deposit, or intussusception, like any organized, living tissue. This opinion has few advocates at the present day. Nevertheless, it is by no means established that the increscence of tubercle may not be occasionally thus affected. The other hypothesis ascribes the enlargement to juxta-position, or to the superaddition of one particle to another. The cause which provoked the original deposit continuing in operation, leads to irritation in the surrounding parts, in consequence of which new molecules are effused around those already formed, and which thus serve as their nuclei. The process is thus not unlike that of amorphous crystallization. It is upon this circumstance that many pathologists have founded an argument against the vitality of tubercle, forgetting that lymph, the basis of all new growths, is deposited precisely in the same manner.

Various notions have been entertained by pathologists respecting the *nature* of tubercles. Hippocrates, Aretæus, Fernal, and Morgagni ascribe their formation to the concretion of a thick, viscid fluid, poured out by the vessels of the affected part, and probably analogous to what has since been termed coagulating lymph. Sylvius de la Boe, whose works were published towards the close of the seventeenth century, looks upon them as lymphatic ganglions in a state of enlargement. This opinion was afterwards adopted, and more fully illustrated by Wepfer and Morton; it has also received the sanction of Portal, and of several distinguished modern authors. Our illustrious countryman, Dr. Rush, considers tubercles as a collection of inorganic mucus; and Rochoux, a recent French writer, thinks that they are merely a degeneration of the healthy, pre-existing tissues into a morbid one. Dr. Baron, an eminent English physician, contends that they are real animalcular products, or, in other words, that they are originally simple hydatids, or minute transparent cysts, occupied by a thin, albuminous fluid, which gradually undergoes inspissation.\* None of these views are even plausible. That of Baron, which

\* "It is probable that all tubercles, wherever situated, and of whatever substance composed, were, at their commencement, small vesicular bodies with fluid contents. It is impossible to say how minute they may have been at their origin, nor how large they may grow before their transformations begin; nor are we acquainted with the circumstances which occasion such transformations. But that they do take place has, I conceive, been demonstrated beyond the possibility of doubt." (Baron's *Inquiry illustrating the Nature of Tubercular Accretions of Serous Membranes*, p. 214. London, 1819.) Further on, the same author remarks: "It is not known how the changes in hydatids are effected; but to these *changes*, certain tubercles owe their existence, and on the *size*, *relative position* and *structure* of the tubercles which are so *formed*, depend the *characters* of many of the most formidable disorganizations to which the human body is exposed." *Ib.*, p. 215.

seems to have been more favorably received than any of the rest, is hardly supported by a single fact. In the inferior animals, tubercles, it is true, occasionally coexist with hydatids; but even in them the occurrence is comparatively infrequent, while it is rarely witnessed in the human subject. Louis never noticed them in his dissections of phthisical patients, and in six thousand bodies examined by Andral, hydatids were seen only in five, and in only one of these was the disease complicated with tubercles. My own experience, although much more limited, is of a similar character; as is also that of Dr. Stokes, one of the most intelligent observers of the day. But independently of the great infrequency of hydatids in our organs and tissues, the fact that the tubercular matter is constantly deposited upon the free surface of the mucous membranes, and infiltrated in the cellular substance in various situations, is at once fatal to the hypothesis of the English pathologist.

Leaving these speculations as unworthy of further notice, it may be stated that all tubercular matter, whatever be its site, form, or consistence, is a direct product of the blood, elaborated by a process of secretion similar to that which presides over the separation of serum, lymph, and pus. The effusion is always effected under the influence of inflammatory irritation, and is preceded, in almost all cases, by the tubercular dyscracia or cachexy. All the solids are enfeebled, and the blood itself is singularly changed in its properties. Even at a comparatively early period it is already quite thin, impoverished, and deficient in globules; its color resembles that of pale claret; and the clot is unusually small and dense. Thus a predisposition is established, which may be excited into action by a thousand extraneous circumstances, and without which there would rarely, if ever, be any deposit of this kind.

In the former edition of this work I expressed the opinion that tubercles are always of inflammatory origin, and a more thorough examination of the subject since has only tended to confirm this conclusion. The concomitant action is usually very languid, or so mild and imperceptible that extensive mischief is often done before the patient is aware of it. In this respect, the development of tubercles resembles that of a chronic abscess, which is rarely characterized by any of the ordinary phenomena of phlegmasia.

The doctrine of the inflammatory origin of this disease is countenanced, if not actually established, by the following circumstances. First, by chemical analysis. The experiments of Hecht, the most satisfactory yet made, afford nearly equal parts of albumen, gelatine, and fibrin; substances which, whether they occur alone, or in combination with each other, are always to be regarded, when found upon the surfaces or in the interstices of the organs, as the result of inflammatory irritation.

Secondly, tubercular matter, as before stated, bears a very great resemblance to spoiled, degraded, or cacoplastic lymph, which is an acknowledged product of inflammation.

Thirdly, the deposit is often excited by cold, especially when conjoined with moisture, and by unwholesome, indigestible, or innutritious food. Dyspepsia frequently leads to the same result. By the former are produced internal congestions; by the latter, a poor and impoverished state of the blood, so favorable to the development of tubercle.

Fourthly, in many cases the disease is attended or preceded by hyperæmia, or active congestion. This often happens in the lungs, the pleura, peritonæum, and lymphatic ganglions.

Fifthly, the doctrine of the inflammatory origin of this deposition derives great plausibility from what occurs in the inferior animals, from mechanical irritation. In the experiments of Cruveilhier, Kay, and Saunders, well-charac-

terized tubercles were produced in a very short time, simply by dropping mercury into the trachea. Similar effects are frequently witnessed in miners, needle-grinders, and weavers, who habitually inhale gritty or irritating matter. Persons of this description are peculiarly prone to phthisis.

Sixthly, scirrhus and encephaloid, in fact, all carcinomatous growths, are of inflammatory origin. All these products are derived from the blood, they gradually become softened, and they ultimately destroy the tissues in which they are situated. Scirrhus, like tubercle, contains fibrin, gelatine, and albumen.

Seventhly, there is no appreciable deposit, secretion, or effusion in any of the shut sacs, cells, or cavities of the body, which is not, strictly speaking, the result of inflammatory action, though this may be so slight as not to attract attention, or to be unattended by the ordinary phenomena of that process.

Are tubercles ever *organized*? Concerning this question, which has been greatly agitated within the last few years, much diversity of sentiment still prevails among pathological anatomists. While many deny that these little bodies are susceptible of this process, on the ground that they are mere morbid secretions, others maintain that they are supplied with vessels, and endowed, like hydatids, serous cysts, and adventitious textures, with an independent vitality. The former of these views has been strenuously inculcated by Stark, Carswell, Alison, and Clark of Great Britain; by Louis, Guillot, and others of France; by Schröder Vander Kolk of Holland; and by Rokitsansky of Austria. The other side of the question has been warmly espoused by many pathologists of equal respectability, and is that which I have taught during the last nine years in my lectures.

Laennec, it is well known, maintained the independent vitality of tubercle, but failed to adduce any evidence of its organization. Lugol, a recent writer, positively asserts that he has, in numerous instances, detected blood-vessels in this deposit. In a valuable paper, in the twentieth volume of the *Medico-Chirurgical Transactions of London*, Dr. P. N. Kingston gives an account of seven cases, in which great numbers of pulmonary tubercles, of the ordinary kind, presented, under the microscope, red vessels, which extended into their interior, and anastomosed, not only with each other, but with the vessels of the adjacent tissues. In one of the cases red vessels were seen in the deposit in the bronchial and mesenteric ganglions. Professor Macartney and Dr. Carmichael of Dublin, also maintain the independent vitality of tubercle. The former states that he has demonstrated the presence of vessels by injection. In a lung which Dr. Bayless, at my request, last summer injected with size colored with vermilion, a number of tubercles exhibited the clearest possible evidence of vascularity. On cutting into a mass of this kind, a tubercle, about the size of a duck-shot, and of a light greyish color, was divided, from the centre of which the artificial fluid, which was still warm, ran in a small jet or stream, precisely as blood flows from a divided vessel. Louis,\* although he does not believe in the organization of this substance, on one occasion observed vessels in it. He injected the pulmonary artery, and found ramifications of it in some of the grey semi-transparent masses.

Another proof, but of a more indirect character, of the organization of tubercle, is furnished by the fact, witnessed by highly respectable observers, that these bodies are often of a yellowish tint in jaundice. This is obviously owing to the admixture of the coloring principle of the bile with the blood, both of which are simultaneously circulated through the heteroclitic mass:

\* *Pathological Researches on Phthisis*, case 29th. p. 331.



Again, it may be presumed that tubercles are organized from the transformations they undergo. The process of softening which generally begins in their centre, beyond the influence of external agents, admits of explanation in no other way.

Finally, tubercles, as will presently be seen, are occasionally converted into cretaceous, sandy, or earthy concretions; which could hardly happen if they were not organized products. In this transformation, which may begin at any part of their interior, the animal matter is gradually absorbed, and its place occupied by chalky matter, or phosphate and carbonate of lime.

I have never been able to trace any nerves or absorbents into these bodies, nor am I aware that this has been done by others; nevertheless, as these structures are every where necessary to organization, it is perfectly philosophical to infer their existence.

At what time the organization of tubercle commences is still an unsettled question. It is reasonable, however, to suppose that nature observes no uniform law in regard to this subject; but that the process takes place at a period varying from two or three days to as many weeks, from the moment of the deposition.

That tubercles are invariably organized, that is, provided with vessels, nerves, and absorbents, no one acquainted with the subject will assert. There are some situations, indeed, in which it would be impossible for the process to be established; as, for example, when the strumous matter is spread over the free surface of the mucous membranes, whether in the bronchial tubes, the uterus, seminal vesicles, or the excretory ducts of the kidneys. Here the heterogeneous nature of the contents of these reservoirs would alone be an insurmountable barrier to the organization, to say nothing of the peculiar modified character of the morbid secretion itself. I say *peculiar modified character*, because it is well known that the chemical and physical properties of the tubercular deposits are widely different in the localities here specified from what they are in other parts of the body. They usually have a deeper yellowish color, are much more curdy and friable, and contain a much greater amount of earthy ingredients. Upon this point, it is impossible, I conceive, that there should be two opinions.

Thus, then, it may be stated, as a general proposition, that, when the tubercular matter is deposited upon the larger mucous surfaces, it is not susceptible of organization; whilst, when it is effused into the cavities of the cellular tissue, into the air-vesicles of the lungs, and into the intermolecular spaces of our organs, it may, and often does, become "part and parcel" of the living frame. Within the last ten years I have examined not less than ten or a dozen specimens of organized tubercles of the kidney, spleen, peritonæum, and lungs, mostly of young subjects. The tubercles were of the miliary kind, and numerous vessels, loaded with florid blood, could be seen shooting into them in every direction, many of them penetrating a considerable distance into their substance. Their vascular supply would thus seem to be derived from the tissues in which they are deposited; and this, in the generality of cases, is no doubt true; nevertheless, there is reason to believe that they occasionally possess a self-organizing power, analogous to that of the adventitious membranes of the splanchnic cavities. Under favorable circumstances, plastic lymph is capable of generating its own vessels, as is shown in the development of the placenta, and the analogous tissues; and, although the vessels thus formed are very small and few in number, they are probably sufficient, in many instances, to preserve the vitality of the tubercle without the aid of the circumjacent textures. Generally, however, such aid is not long with-

held ; for as the newly created vessels extend from the central to the peripheral portion of the heterologous deposit, they speedily communicate with the arteries and veins of the affected organ. It is in this manner that the organization of tubercles may be supposed to be effected, and in proportion to its perfection will be their power of resisting such agents as have a tendency to destroy them.

In making these remarks, I do not wish to be understood as asserting that I have seen the vessels which are here supposed to form the proper circulation of tubercle : their existence is altogether assumed from the analogy afforded by encephaloid growths, and the adventitious membranes. Actual observation will, perhaps, never avail us much in determining the question, since the subject is beset with difficulties scarcely to be found in any other morbid deposit. But I do assert, unhesitatingly, that I have repeatedly traced vessels into such tumors from the tissues around them, and, that upon dividing them, the section thus made has frequently exhibited small florid dots of blood. But it may be objected that these vessels have never been injected. Granting this to be true, and what, it may be asked, does it prove? Are we reduced to the necessity of denying the vitality of a structure, because we cannot succeed in throwing foreign substances into its vessels? If this be a fair criterion, then we must conclude that the cornea, the crystalline lens, the membrane of Jacob, the inner coat of the arteries and veins, the endocardium, and the arachnoid tunic of the brain, together with the chorion and amnion, are not organized. But who would be so silly as to do this, when daily observation demonstrates that these textures are abundantly supplied with vessels, nerves, and absorbents, though none of these tissues can be detected by inspection, no matter to what methods we resort to for the purpose.

The recent inquiries of Mr. Gulliver\* on the *microscopical* elements of tubercle render it exceedingly probable that this substance, like the most highly organized tissues, has its origin in cells. These cells, however, appear to be in great degree, if not entirely destitute of the plastic force, in consequence of which they always have a tendency to retrograde and degenerate, instead of increasing in number towards the centre, or, in other words, multiplying and evolving organic germs. The mass of the tubercle consists of granular matter, corpuscles, and cells, which may either occur separately, or be mixed together in various proportions. Of these the first is the most essential, inasmuch as it is seldom or never absent. It is composed of infinitely minute particles, and of delicate spherules, remarkably variable in size, but usually from 1-3000th to 1-8000th of an inch in diameter. The granular matter is almost always mixed with the other constituents, and frequently forms nearly the entire mass of caseous tubercle. The corpuscles are either globular or oval, but often very irregular, or even shapeless. They vary from the 1-6000th to 1-2000th of an inch

Fig. 33.



in diameter. They occur in crude tubercular matter, and are supposed by Mr. Gulliver to be merely imperfect, degenerating, or blighted cells and nuclei. The cells may be frequently recognized in greyish miliary tubercle, in the lungs and serous membranes, and their most common size is from the 1-2600th to 1-1400th of an inch in diameter. It is only in minute and recently formed tubercle that they are perfect or well-marked ; as the heteroclit body increases in magnitude they disappear, and probably degenerate into the corpuscles and

\* Appendix to Gerber's General Anatomy, p. 86.

granular matter above mentioned. The various appearances here spoken of are seen in Fig. 33, from Gulliver.

When tubercular matter has arrived at the crude stage, it may remain stationary for an indeterminate period. The circumstances which favor its preservation are dependent partly upon its own intrinsic powers, and partly upon the condition of the surrounding tissues. The state of the general health also, no doubt, exerts an important influence. When tubercles exist in excess they may, so to speak, produce their own destruction, by the pressure which they exert upon each other, and upon the parts in which they are developed. In what is called "galloping" consumption, the period of latency may not exceed five or six weeks. In the ordinary form of the disease, however, the interval is much longer, and may extend to several years.

The changes which a crude tubercle may undergo are three: softening, absorption, and the chalky or cretaceous transformation. Of these the first is infinitely the most frequent, and is always accompanied by more or less destruction of the surrounding tissues.

*Softening* constitutes the third stage of tubercle. By Laennec and Louis this change of consistence is supposed always to begin at the centre of the morbid mass; Andral, Roche, Carswell, and others, on the contrary, maintain that it may commence at any part, indifferently, at the centre or at the circumference. A careful examination of the subject has led me to conclude that the process may take place as described by the latter writers, but it unquestionably begins, in the great majority of cases, in the interior of the morbid deposit. In fact, so common is this that it may be regarded as the law, the other as the exception. The softening sometimes occurs simultaneously at several points, and is then usually very rapid. As it advances, the tubercular substance presents a moist, macerated, and unctuous character, and is gradually transformed into true scrofulous pus. When the degeneration involves the entire mass, it is usual to find two different kinds of matter in the little abscess which now occupies its place. Of these one is thick, straw-colored, and inodorous, like laudable pus; the other thin, whey-like, and mixed with small, opaque, cheesy flakes.

Agreeably to the doctrine which it has been my endeavor throughout this chapter to enforce, that tubercles are organized structures, their softening may be supposed to be analogous to slow suppuration, by which they are gradually broken down and dissolved. These bodies, in fact, contain within themselves the germs of their destruction; they possess only a low grade of vitality; their power of resistance is comparatively feeble; and hence they readily yield to whatever has a tendency to disturb their molecular arrangement. After they have existed for an indefinite period, they create more or less irritation in the textures immediately around them. This irritation is speedily propagated to the tubercles themselves, which, as they have little plastic force, soon yield to the invasion, the rapidity of their softening being always in direct proportion to the intensity of the exciting cause, and the density of the morbid mass.

Those, on the other hand, who believe that tubercles are inorganizable products, maintain that their softening is effected solely by the agency of the surrounding tissues. According to this theory, they produce, like any other extraneous bodies, an irritation, — an afflux of blood, — followed by a secretion of purulent matter; this insinuates itself into the heterologous deposit and causes its disintegration. This theory, originally advanced by Lombard, and embraced by Andral, Alison, Carswell, and others, is opposed by the fact, previously adverted to, that the softening generally begins at the centre of the morbid product, where the surrounding tissues can exert no influence.



The softening takes place much more rapidly in some organs than in others, in which it does either not occur at all, or only after a long period. In the lungs, where the process has hitherto been chiefly studied, it may take place as early as the end of the first month from the time of the deposition, though generally not until much later. Upon this subject, however, it is obviously impossible to lay down any definite rule, as the production of the phenomenon in question must necessarily be influenced by a great variety of causes, such, particularly, as the extent of the disease, the state of the patient's health, and the density of the heterologous deposit. Occasionally the softening goes on simultaneously over a large extent of surface, so as to break down one-third, a half, or two-thirds of an organ; but this is rare, and is confined exclusively to acute cases. In the lungs, the degeneration usually begins at the summit, and gradually extends towards the base, as is shown by the fact that if these viscera be examined in this direction, we successively find, at various heights, excavations and tubercles in different stages of softening, the more solid being almost always lowest in the scale. Before the changes, of which we have now spoken, take place, the morbid deposit appears to create little disturbance in the general economy, and may exist, sometimes to a very considerable extent, without giving rise to symptoms indicative of its presence.

After having become perfectly soft, the tubercular matter is either absorbed, or, if it be favorably situated, it works its way out. In the lungs, it usually breaks into the bronchial tubes, leaving thus, not unfrequently, a considerable number of *excavations* or *fistulous apertures*. In the examinations of Louis, these caverns were never found entirely empty before the end of the third or the beginning of the fourth month, counting from the time of the invasion of the disease. In recent cases of this kind, the walls of the chamber are soft, and lined by a thin layer of lymph; in the more ancient ones, the false membrane is dense, greyish, sometimes semi-cartilaginous, and from one fourth to one third of a line thick.

These excavations are most common in the lungs: they are sometimes found in the brain, liver, spleen, kidney, and bones; but so seldom, that our knowledge concerning them is still very imperfect. In the kidney I have met with this lesion only once, in a young man whose case will be described in another place. In the long bones, these caverns, as they may be termed, occasionally communicate with the medullary canals, or some contiguous joint, establishing thus an analogy with tubercles of the lungs opening into the bronchial tubes; in the short bones, as those of the spine, it is not uncommon for them to work their way to the surface by long, tortuous passages, which it is always difficult, and frequently impossible to heal.

The size of these caverns is variable. I have frequently found them as large as a hen's egg, and, in some instances, even of the volume of the fist: generally, however, they are much smaller, not exceeding the dimensions of a hazelnut, an almond, or a walnut. The lesions which are observed in the tissues around these cavities, and the changes experienced by the vessels, will be more fully described in the chapter on tubercles of the lungs, to which we must also refer for an account of the process of cicatrization, as it takes place much oftener in those organs than in any other parts of the body.

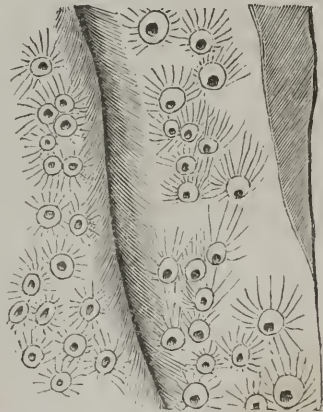
It is not improbable that crude tubercles, after a certain period, may be absorbed, and disappear. This conjecture, at all events, is countenanced by what is occasionally witnessed in the human subject, in which, after the symptoms of pulmonary phthisis are apparently well developed, they gradually vanish, and the patient regains his accustomed health. In scrofulous affections of the lymphatic ganglions of the neck and mesentery, especially of young

children, there is every reason to believe that the tubercular matter is often removed in this manner. In the bones, too, the probability is that it is not always followed by softening. The interesting observations of Carswell, however, throw the only direct and positive light upon the subject with which I am acquainted. While conducting some experiments on the artificial production of tubercles in the liver of the rabbit, he repeatedly found that their complete removal was effected by absorption and excretion. When accomplished by the latter process, which was more commonly the case, no trace of disease remained. When caused by absorption, the surface of the organ exhibited irregular furrows or depressions, apparently produced by atrophy of the hepatic parenchyma in the site of the abnormal deposit.

Finally, tubercles may undergo the cretaceous, sandy, or *calcareous degeneration*. This increase of consistence is most liable to occur in those cases wherein these bodies contain a great disproportion of curdy, friable substance, and in which they have established a sort of tolerance in the surrounding tissues. The transformation, although noticed in various situations, is most frequent in the summits of the lungs and in the bronchial lymphatic ganglions. The animal matter of which crude tubercles naturally consist appears to be abstracted, and its place supplied by the earthy salts, especially the phosphate and carbonate of lime, which have been shown by Thenard, Lombard, and L'Heritier, to form from ninety-three to ninety-eight per cent. of the entire mass. Thus it would seem that in cretaceous and common tubercle the proportions of the ingredients are merely reversed. Advanced age greatly favors this transformation, which, however, sometimes occurs in very young subjects and even in children.

When the tubercles are very numerous, or unusually voluminous, they must necessarily exert injurious pressure upon the parts in their immediate vicinity, and thus embarrass, if not entirely interrupt, their functions. The proper tissues of the organs are more or less strangulated, and many of the vascular ramifications are obliterated by absorption or adhesive inflammation. Even the larger trunks are sometimes very much encroached upon by these bodies. Schröder Vander Kolk mentions a case in which the pulmonary artery and vein were so much diminished from this cause that they admitted a common sized probe beyond half an inch. It is in consequence of this obstruction that a sort of supplemental circulation is sometimes established, the object of which is to compensate for the otherwise insufficient nourishment of the affected tissues. The new vessels are arranged in arborescent lines, or in the form of a delicate and beautiful network around the tubercular deposits, to the development and vitality of which they no doubt materially contribute. They are often very numerous, and may be readily filled with fine injection. Fig. 34, from Lobstein, is an excellent illustration of these vessels from a case of granulations of the peritonæum.

Fig. 34.



## SECTION II.

## MELANOSIS.

One of the most singular, and, at the same time, one of the rarest of the heterologous formations, is the melanotic, for a correct knowledge of which we are indebted to Laennec. The first account of this disease was given by this distinguished pathologist in 1806, in the *Bulletins de la Faculté de Médecine de Paris*; and the same description was afterwards embodied in his learned work on thoracic maladies. The term employed to designate this morbid product is a Greek compound, literally signifying the black disease, and is synonymous with what Dupuytren and Alibert, with some others, have since called black cancer.

The account which Laennec has left of this accidental product, and which may be considered as one of the most accurate and graphic that has ever been furnished, describes it as a homogeneous substance, very similar in its structure and consistence to a bronchial gland, of a deep black color, opaque, humid, and slightly unctuous to the touch. This substance, after a while, has a tendency to become soft; the process by which this is effected generally commencing in the centre, and gradually proceeding towards the circumference, until it is entirely broken up and dissolved. When this is accomplished, nature sets up an eliminating effort, the surrounding parts take on inflammation, and the heterologous matter is finally expelled, thus leaving a corresponding cavity, which either continues open, is lined with lymph, or else completely obliterated.

No age nor sex seems to be exempt from this disease, though it is, without doubt, much more frequent in the old than in the young. Nor is it confined exclusively to the human subject. Dupuy and Rodet have frequently seen it in the horse; Breschet and others, in the dog, cat, rabbit, rat, and mouse; and I myself often in the ox. What is remarkable, this substance is much more common in white than in colored horses; and the same is true, I have reason to believe, in regard to cattle. To what this circumstance is to be attributed, it is not very easy to determine, unless we admit the conjecture of Andral, that the black pigment of the skin, instead of being deposited in its usual place, is transferred to other organs and textures in which it is not naturally found. In the horse, melanosis most frequently occurs under the shoulder-blade, in the pelvis, around the anus and vulva, and along the under surface of the tail. It is also frequently observed beneath the skin, where it forms numerous chaplets, composed of granular bodies, from the size of a filbert to that of a small egg. Noack states that he has seen it in certain birds, as the heron.

The melanotic substance has been examined by different chemists, both in England and on the continent of Europe; and, although the results somewhat vary, yet they all agree in one important particular, which is, that it bears a very strong analogy in its composition to that of the blood. My limits will not allow me to enter into any minute details concerning this subject, and I shall therefore merely observe that the most complete investigation which has been made, is that of Dr. Barruel, of Paris. According to this distinguished chemist, melanosis of the human subject is essentially composed of the coloring matter of the blood, united with fibrin, and of three distinct fatty substances. Of these, the first is soluble in alcohol at a moderate heat, and susceptible of crystallizing in small brilliant scales; the second is soluble only in boiling



alcohol, soft, and amorphous ; the third is fluid at the ordinary temperature of the atmosphere, of a reddish-brown color, and contains a considerable quantity of phosphate of lime and iron. The result of this analysis is fully confirmed by that subsequently obtained by Dr. Hecht,\* from a specimen of melanosis of the lungs ; and it corroborates, likewise, its identity with the coloring matter of the blood.

Dr. Henry, of Manchester, found that a stream of chlorine, passed through a solution of this substance, destroys its black color, and throws down light yellowish flakes. Boiling produces no change, not even when a small quantity of caustic potash is added. Acids do not alter it, except the nitric, which turns it yellow. Corrosive sublimate, the nitrate of mercury, and the muriate of tin precipitate it, the supernatant fluid being left quite clear.

To these analyses it may not be improper to add the results recently obtained by Dr. Foy, of Paris, from a melanotic tumor of the horse. They are as follows :

Albumen	-	-	-	-	-	15.00
Fibrin	-	-	-	-	-	6.25
A highly carbonized principle, probably altered cruor						31.40
Water	-	-	-	-	-	18.75
Oxide of iron	-	-	-	-	-	1.75
Sub-phosphate of lime	-	-	-	-	-	8.75
Muriate of potash	-	-	-	-	-	5.00
„ soda	-	-	-	-	-	3.75
Carbonate of soda	-	-	-	-	-	2.50
„ lime	-	-	-	-	-	3.75
„ magnesia	-	-	-	-	-	1.75
Tartrate of soda	-	-	-	-	-	1.75
						<hr/> 100.40

The melanotic matter is miscible with water and alcohol, opaque, and without any marked taste or smell. When placed in contact with white linen, it readily communicates to it its peculiar tint ; but the stain that is thus produced is easily removed by ablution. Exposed to the atmosphere, it becomes dry, brittle, and pulverizable, and a long period elapses before it undergoes decomposition. By burning, it is converted into a dark carbonaceous substance, and emits a strong empyreumatic odor.

The *color* of melanosis, as might be expected, is considerably influenced by accidental circumstances, as the quantity of cruor and cellular tissue entering into its composition. It may be said always to incline to black ; but not unfrequently it presents various shades of brown and yellow, which are usually most conspicuous when this substance is stirred in a small quantity of water. In its consistence, melanosis varies from the fluidity of ink to the density of fibro-cartilage.

The *minute texture* of melanosis has been carefully investigated by Müller,† who finds it to consist of a fibrous network, and of numerous meshes, occupied by free, unadherent pigment cells, the largest of which are more than 0.00108 of an English inch in diameter ; while the smaller vary from 0.00105 to 0.00039, or even less. They are of a pale yellow color, dark, or dark brown,

\* Lobstein, *Traite d'Anat. Patholog.*, t. i., p. 463.

† *Op. cit.*, p. 56.

and of a rounded, oval, or irregular figure; some are elongated, and a few are actually caudate, terminating at one or both extremities in a point, or in a fibril. The pigment cells are not present in all specimens, and the smaller ones are supposed to be young cells set free by the rupture of the old. They are filled with yellowish or blackish granules, and a few of the larger ones occasionally contain, independently of these bodies, a nucleus with its nucleolus. In some of his examinations, Müller found the granules free, and dispersed through the meshes of the fibrous network. It is probable that, in these instances, the germinal cells were dissolved, or broken down, so as to allow their contents to escape.

With respect to form, there are six varieties under which this matter is deposited, the tuberoid, lamellated, dot-like, infiltrated, ramiform, and liquid.

The *tuberoid* variety, as the name indicates, occurs in distinct masses, varying in diameter between a currant and a walnut, of a dull sooty color, and of a spherical, ovoidal, conical shape. (Pl. II., Fig. 1.) By the agglomeration of a number of such bodies, large tumors are sometimes formed, with a rough, lobulated surface, which always attain their greatest development in the cellular and adipous tissues. In the human subject, their size seldom exceeds that of the fist; in the horse, on the contrary, they have been found to weigh from twenty to forty pounds.

A thin, transparent covering, evidently formed out of the natural tissues, invests these tumors, and gives them the appearance of being encysted. Vessels and nerves are occasionally seen ramifying over their surface, or penetrating into their substance, and in many cases they are intersected by fibrous filaments, which are either derived from the general envelope, or they are the remains of the lacerated cellular substance into which the heterologous matter is originally deposited. These circumstances have led to the opinion — at first sight plausible enough, yet wholly erroneous — that these tumors are organized. Of the vessels which are distributed to the melanotic mass, the veins greatly predominate; they are often very large and tortuous, and Noack thinks they terminate on the interior of the cyst by open mouths. Both arteries and veins are incapable of being injected, the matter used for this purpose being always extravasated in the substance of the morbid deposit.

When the tumor is developed on the serous surfaces, it frequently presents a pedunculated appearance, like certain polypes of the uterus and vagina. (Pl. II., Fig. 2.) In such cases it is always surrounded by a distinct cyst, of which it is difficult to say whether it is a new formation, or simply an extension of the natural membrane. There is another variety of melanotic tumor in which the covering seems to be formed by condensed fibrin, effused, in all probability, in consequence of the irritation excited by the presence of the foreign matter. Sometimes the cyst is of considerable thickness, firmly connected with the circumjacent tissues, and furnished with minute vessels; generally, however, it is remarkably thin, soft, flocculent, and without the least visible trace of organization. This variety of melanosis occurs most commonly in the liver and the brain. It is extremely rare. Carswell states that he has never seen an instance of it, and Laennec appears to have met with it only twice. I have noticed it repeatedly in the liver of the ox.

The *lamellated* variety is observed chiefly in the inferior animals; it is extremely rare in the human subject. (Pl. II., Fig. 3.) It is confined exclusively to the serous membranes, where it is usually deposited into the connecting cellular tissue, in small, irregular patches, of a black brownish color. More rarely the matter is poured out upon the free surface of these textures. When this happens, the layer is seldom more than half a line in thickness, of a soft, pulpy







Plate II.

Fig. 1. Tuberiform v.



Fig. 2. Pedunculated v.



Fig. 3. Stratiform v.



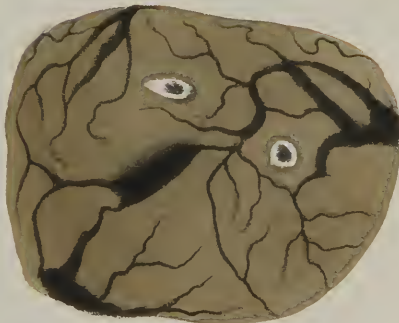
Fig. 4. Punctiform v.



Fig. 5. Infiltrated v.



Fig. 6. Ramiform v.







consistence, and covered with a thin, transparent pellicle of new formation. The peritonæum is the most common seat of the lamellated variety of melanosis; and here it is often difficult to distinguish it from the spurious form of the disease, caused by the deposition of blood, and the subsequent changes which this fluid undergoes from contact with the acid contents of the alimentary tube. In some instances the serous membranes present a stained appearance, as if the heterologous matter had been effused into their intermolecular spaces. Such spots are not infrequent in the peritonæum of those who die of ascites.

In the *dot-like variety* (Pl. II., Fig. 4,) the melanotic matter appears in small points, thousands of which are sometimes scattered over the surface of the affected organ, giving it a singularly speckled aspect. This form of the disease, which may be easily imitated by dusting a piece of white paper with soot or powdered charcoal, is most common in the lungs, liver, and subserous cellular tissue of the alimentary tube. I have also repeatedly seen it in the skin of white horses. When the points are very close, the affected part may present the appearance of being *infiltrated*, as in Plate II., Fig. 5. *Ramiform* is the term used when the adventitious matter is contained in the vessels, deposited upon their surface, or effused among their tunics. This variety, represented in Fig. 6, is chiefly met with in the liver and the lymphatic ganglions, either alone, or in association with the infiltrated and tuberoid forms.

The melanotic matter may present itself in a *fluid state*. This form, however, is exceedingly rare, and is noticed chiefly in the serous cavities, the lungs, and the urinary organs. A considerable number of examples of collections of liquid in the peritonæal cavity, of the color and consistence of ink, are on record. It must be confessed, however, that it admits of much doubt whether the effused matter was usually anything more than blood, altered in its composition by the agency of the absorbent vessels. Instances in which melanotic fluid was expectorated, though rare, are mentioned by Lecat, Morgagni, Lieutaud, Lorry, and Bönnet. Bartholin, Proust, and other chemists, have met with examples in which this substance was voided along with the urine. Black, inky-looking matter has often been discharged by vomiting and stool. Trousséau and Leblanc, in their memoir on melanosis, cite a case in which a cyst, developed in one of the kidneys, contained eight ounces of liquid, similar in its physical properties to that in question.

The *tissues* most prone to the melanotic deposition are, beyond all comparison, the cellular and adipous. Large masses of this substance are often met with under the skin, particularly of the trunk, in the mediastinal cavities, in the folds of the mesentery and omentum, and around the kidneys. In horses, the subcutaneous substance of the buttock, anus, vulva, and tail, is a very common seat of the disease. Of the different organs, the liver, lungs, spleen, eye, kidneys, and ovaries, may be enumerated as being most frequently affected. The lymphatic ganglions, especially those of the bronchiæ, are also very liable to it. The bones, fibrous and serous membranes, the pancreas, arteries, and salivary glands, are seldom implicated; while the brain and spinal cord, the nerves, the veins, the muscles and their tendons, the cartilages, the synovial and mucous membranes, the uterus and mammary glands, the thyroid and thymus bodies, the prostate, testicle, seminal vesicle, and supra-renal capsule, enjoy almost an entire immunity from its invasion. Melanosis of the heart has been noticed by Gohier, Fawcington, Breschet, Halliday, Cruveilhier, Cullen, and Carswell; but this is the only portion of the system of involuntary muscles in which this disease has hitherto been found.

The system is not unfrequently affected with a genuine *melanotic diathesis*, the disease in question occurring either simultaneously, or in tolerably rapid

succession, in a great number of organs and tissues. Of this many examples are on record. One of the most remarkable of the kind was published some years ago by Dr. Norris, an English physician.\* In this instance, not only was the external surface extensively studded with black tumors, but immense numbers were seen scattered over the stomach, intestines, mesentery, and omentum; the lymphatic ganglions, kidneys, pancreas, and liver were also more or less affected; the lungs were thickly mottled throughout the greater part of their texture; and the heart was literally encrusted with them, both externally and internally. The brain was healthy, but the dura mater was deeply involved. In the interesting case recorded by Professor Alison, of Edinburgh, the integuments, mammæ, ovaries, membranes of the brain, heart, lungs, pleura and peritonæum, the sternum and ribs, together with a large portion of the parietal and occipital bones, were all affected with this disease; some of them in a very high degree. Like tubercles, then, this heterologous deposit seldom occurs in a single organ, but generally in a considerable number of them, which corroborates the assertion previously made, that the system occasionally labours under a melanotic diathesis.

Melanosis may exist alone, or be combined with other heterologous formations. Of these the most common is the scirrhus; the rarest, the tubercular. Dr. Rouzet met with a case of carcinoma of the breast, in which a black fluid, evidently of the nature of that in question, constantly exuded from the ulcerated surface. The tissues immediately around the melanotic deposit are often very much contaminated. Sometimes they are only hardened, or perhaps softened; at other times they are extensively infiltrated with the morbid matter, and of a deep black color. When the tumors are developed in the muscular substance, the fibres are merely pushed aside by them, without being contaminated by the disease. The nerves and bones likewise remain intact.

Melanotic tumors, after having acquired a certain size, generally *remain stationary*, giving rise to little or no inconvenience, save what results from their bulk and consequent pressure. At times, however, they manifest a disposition to ulcerate, and, when this happens, a most intractable sore is left, with hard, ragged edges, from the surface of which there is a constant discharge of black, inky matter, mixed with blood, pus, or a thin, fetid, ichorous fluid, formed by the surrounding structures. When removed, the most remarkable feature of these tumors is their tendency to reappear in the neighborhood of the cicatrice, or in some remote organ.

Notwithstanding that Laennec has asserted the contrary, the melanotic matter is probably always poured out in the liquid form. Indeed, we can scarcely conceive of the possibility of its being secreted in any other way. In the course of a short time after the deposition has taken place, the matter becomes inspissated, by the gradual absorption of its more attenuated particles; and it is in this manner that it finally acquires the hardness and density of a solid substance. What corroborates this view, is the fact, that thin, liquid melanotic matter is sometimes found in the splanchnic cavities without any breach of the serous membranes, and that it frequently exudes in this form from the surface of carcinomatous and other tumors, in a state of ulceration.

Of the *causes* of this disease, and of the states of the system which predispose to it, nothing is known with any degree of certainty. That the melanotic matter is derived immediately from the blood, both anatomical examination and chemical analysis abundantly show; but how far, or in what respect, this

\* *Medico-Chirurgical Review*, October, 1836.

fluid is altered before the deposition is effected, are points in the history of this disease concerning which pathology and physiology are equally silent and undetermined. If we remember that melanosis is essentially composed of the same elements as the coloring matter of the skin and of the choroid coat of the eye, we may be allowed to suppose that this substance, existing in an unnatural quantity in the blood, is deposited, by an aberration of the nutritive functions of the vessels, into organs and tissues in which it is not found in the normal state. Noack regards the black matter as a secretion from the veins, an opinion in which he is joined by Dr. Hodgkin. This view, however, is entirely inadmissible on physiological grounds, inasmuch as there is no instance, so far as we know, except in the liver, in which the veins perform such an office.

Melanosis, even when in a state of suppuration, does not seem to be communicable by immediate contact. Gollety-Latournelle repeatedly attempted to propagate the disease from infected mares to healthy horses during coition, but without success. Gohier inoculated horses, asses, and dogs with matter of this kind, without, in a single instance, inducing the disorder.

My own experience induces me to believe that melanosis is extremely rare in the inhabitants of this country. I have met with it only a few times in a great many examinations. It is said to be most common in individuals of a melancholic temperament. In the inferior animals, especially in horses and asses, it often betrays a hereditary tendency, and the same circumstance has occasionally been witnessed in the human subject.

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### SECTION III.

#### SCIRRHUS.

Concerning no one of the heterologous formations have anatomists expressed such a diversity of sentiment as of that, the nature of which we are about to investigate. Notwithstanding the numerous treatises that have been published within the last thirty years, it is a singular fact that we are scarcely in possession, even at the present moment, of an accurate and unexceptionable definition of the term scirrhus. The reason of this may be discovered, if I mistake not, in the circumstance that all malignant diseases, whatever be their origin, seat, or structure, were described, until very recently, under the vague name of "cancer." Nor was this the only difficulty. Scirrhus, as will be shown hereafter, often co-exists with encephaloid, which, independently of the varieties to which it is itself subject, must have been a source of much confusion and embarrassment. No wonder, then, that writers should have failed in presenting clear and definite notions on the subject. Indeed, with all the light that has been thrown upon the heterologous formations by morbid anatomy, it must be confessed that the most experienced find it sometimes extremely difficult, even at the present day, to draw a correct line of demarcation between scirrhus and encephaloid.

How far the definition which we are about to give is free from objection, must be left to others to determine. Those who are acquainted with the difficulty of the subject will agree with me at least, that any effort of the kind, although it may be only approximately correct, is much better than none. No



lesion can be studied with advantage, unless the student have a proper notion of its nature at the very outset of his examination; and no where is this more true than in the disease before us. With these remarks, I proceed to define scirrhus to be a hard, crisp, opaque substance, of a light greyish color, with dull yellowish, fibrous intersections, organized, liable to lancing pain, occurring for the most part after the middle period of life, and passing sooner or later into ulceration.

This definition is not so concise as could be desired, yet, on the whole, perhaps as correct a one as can be given in the present state of the science. Like tubercle, scirrhus has its regular period of growth, maturation, and decay; like it, it is merely a local manifestation of a constitutional disorder; and like it, its tendency is ultimately to destroy, not only the tissues in which it is deposited, but the life of the individual. To comprehend, in the fullest manner, the circumstances which modify its physical characters, the disease should be studied in its various stages and in different organs of the body.

Scirrhus occurs as a solitary tumor, or in disseminated masses, as an infiltration, or as a lamella, of variable extent and thickness. Of these varieties the first is by far the most common; both the others, especially the second, are infrequent.

In the *tubercloid* form (Pl. III., Fig. 1), the most common, as we have just stated, of all, the heterologous substance forms small circumscribed nodules, the number of which, as in the liver, is sometimes very great, and the consistence of which varies between fresh pork and fibro-cartilage. Their size and shape are much influenced by the nature of the tissues in which they are developed, and by the resistance which is offered to their progress. Single tumors of this kind are rounded, ovoidal, or conical; when, on the contrary, several are agglomerated together, they are generally very irregular, angular, and more or less lobulated. In their size they vary between a mustard-seed and an adult head, their average being that of a billiard-ball, a lemon, or an orange.

In the *infiltrated* form (Plate III., Fig. 2), the morbid matter is diffused through the interstices of the affected organ, which it converts into a substance similar to itself. It is extremely infrequent, and occurs chiefly in the lungs, liver, uterus, kidney, and bones. The primitive texture, whatever it may be, gradually loses its normal color and consistence, but its volume is seldom much augmented or diminished.

Finally, the adventitious matter may appear in the form of a *lamella*, layer, or stratum, either beneath or upon the surface of the serous and mucous membranes. This variety, exhibited in Plate III., Fig. 3, is most frequently met with in the submucous cellular tissue of the œsophagus, stomach, and bowels. In these situations it is not unusual to find large patches of this description, of a pale bluish tint, crisp, from one to six lines in thickness, and of a dense, fibro-cartilaginous consistence. The lining membrane, together with the muscular tunic, sooner or later participates in the disease; and the part of the tube corresponding with the seat of the lesion becomes hard, rigid, and contracted.

A scirrhus tumor creaks under the knife, is opaque, firm, inelastic, and of a white bluish color, with various shades of grey, rose, and drab. These tints are most conspicuous when there is an admixture of bile, blood, or pus, as sometimes happens when the heterologous matter is very old. Thin slices of it are found to be semi-transparent, flexible, and elastic; when dried, they exhibit nearly all the properties of the horny tissue. Fibrous intersections,







Plate III.

Fig. 1. *Tuberiform v.*

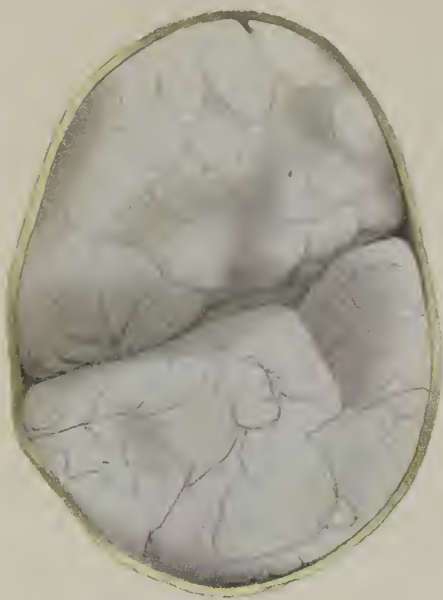


Fig. 2. *Infiltrated v.*

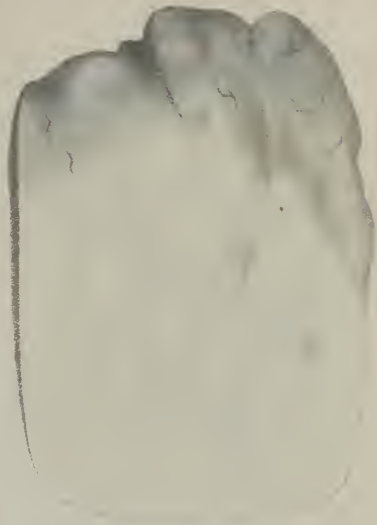


Fig. 3. *Stratiform v.*

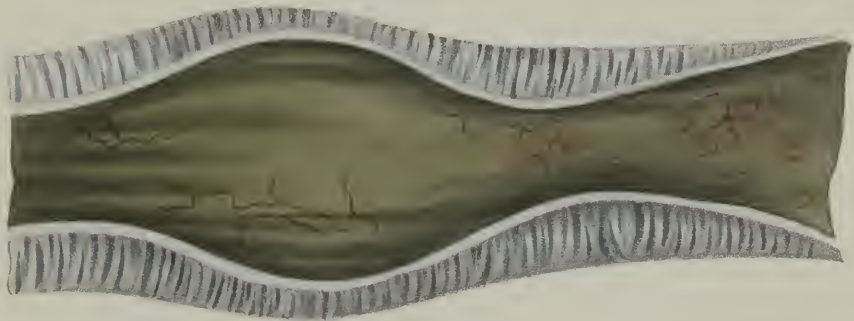


Fig. 4. *Mammary v.*

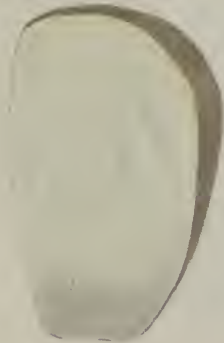
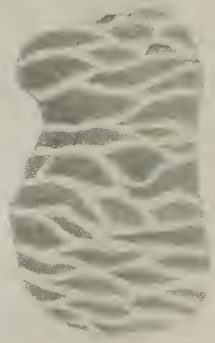


Fig. 5. *Pancreatic v.*



Fig. 6. *Reticulated v.*





generally of a slight yellowish color, are seen to pervade the diseased mass, starting from the centre as their common nucleus, and radiating thence towards the circumference. These lines are merely the remains, in most cases, of the cellular substance of the affected part, and are often so arranged as to resemble very closely the fibrous structure of an unripe pear or turnip. A creamy-looking fluid is occasionally incorporated with the heteroclite mass, and constitutes the most decided evidence of its carcinomatous nature.

Scirrhus growths, especially such as occur in the female breast, occasionally contain hydatids. A more common appearance is the development of cysts, filled with a thin, greyish, gummy substance, meliceric matter, or even pus, though the latter is very rare. Clotted blood is likewise present in some instances. By some writers, scirrhus tumors are said to be always furnished with a distinct cyst; as a general rule, however, this is not the case, and this forms one of their characteristic features. When they are very large and old, the cellular tissue around them is generally a good deal condensed, but seldom to such an extent as to entitle it to the appellation of a capsule. Distinct vessels are very rarely perceived in them; nor is it possible to discern any nerves.

Scirrhus is susceptible of considerable variation of structure, depending chiefly upon the quantity of the adventitious matter, its vascularity, its mode of aggregation, and the pressure which is exerted upon it by the surrounding parts. A knowledge of this fact has led to the establishment of several subdivisions or varieties, of which we need specify only a few of the more common and important.

Under the title of *mammary sarcoma*, Abernethy describes that form of scirrhus, in which an appearance similar to a section of the female breast, or a boiled udder, is particularly manifest. The tumor has a lobulated arrangement, and is intersected in various directions by fibrous bands of a dull white, bluish grey, or pale straw color. It is ordinarily solitary, and rarely acquires much bulk. This variety is shown in Fig. 4.

Sometimes the tumor is of the color and consistence of the pancreas, and then constitutes what is termed, by the above named writer, *pancreatic sarcoma*. It is firm, dense, inelastic, and composed of numerous lobules separated by bands of cellular tissue, and resolvable into granules, or smaller bodies. In its bulk it may equal an orange, or a large fist; it is occasionally enclosed in a general capsule, and usually selects the breast or lymphatic ganglions for its seat. The pancreatic variety is exhibited in Fig. 5.

The *lardaceous variety*, as it is denominated by the French pathologists, is met with chiefly in the lungs, the uterus, and the mammary gland. The adventitious matter is diffused through the tissues of the affected organ, which it compresses, alters, and finally transforms into a substance similar to itself. It cuts with considerable crispness, and closely resembles a section of fresh pork, having little or none of the fibrous or linear arrangement of ordinary scirrhus. The extent of the deposit is generally inconsiderable; in some instances, however, it affects one fourth, a half, or even two thirds of an organ, the weight of which is always increased, while its form and dimensions commonly remain unchanged. It does not seem to be determined whether this variety of scirrhus is of a malignant character in the first instance, or whether it becomes so only during its progress. Be this as it may, it is certain that it may continue in a crude state for many years; at length, however, it takes on softening, and then pursues the same career as ordinary cancer. Fig. 2 shows the lardaceous variety of carcinoma as occurring in the lung.



Perhaps the most common variety of scirrhus is that recently described by Müller under the name of *reticular carcinoma*. The ordinary seat of it is the mammary gland, but it may also occur in other parts, as the stomach, lymphatic ganglions, lip, eye, heart, and anterior mediastinum. It is distinguished by its white or bluish reticular figures, by its large bulk, and by its tendency to assume a lobulated form; its consistence ranges between scirrhus and encephaloid. This form of cancer is composed of grey globules, imbedded in the meshes of a fibrous network, which is not seen until after their removal by scraping or maceration. They are similar to those of ordinary scirrhus, and often contain two or more minute vesicles, nuclei, or granules; the latter also exist in great numbers in the intervals between the cells; and some of the smaller are endowed with molecular motion. The cells themselves measure 0·00023 to 0·00043 of an English inch in diameter, while that of the granules does not amount to one fifth of that size. The reticular figures, which give this variety of scirrhus its distinctive features, are white, or yellowish white, and of a very irregular shape; sometimes they have an arborescent arrangement, at other times they appear in spots. They are peculiar formations, not dilated vessels with hypertrophied walls, such as are sometimes seen in the ordinary form of the disease, but they are produced by the inlaying of white grains in the grey mass. These grains are not vesicular, but solid, opaque granules, agglomerated together so as to form roundish or elongated corpuscles, twice or three times as large as the globules of the blood. Fig. 6 conveys a good idea of the fibrous bands of this variety of scirrhus.

The composition of scirrhus matter has been examined by different chemists, but the most recent, as well as the most complete, analysis is that published by Foy, and which is as follows:

Albumen	-	-	-	-	-	42·00
White fatty matter	-	-	-	-	-	5·00
Red fatty matter	-	-	-	-	-	3·25
Fibrin	-	-	-	-	-	5·85
Water	-	-	-	-	-	5·00
Oxide of Iron	-	-	-	-	-	1·65
Subphosphate of Lime	-	-	-	-	-	16·60
Carbonates of	{	Soda	-	-	-	5·00
		Lime	-	-	-	6·60
		Magnesia	-	-	-	0·85
Hydrochlorates of	{	Potassa	-	-	-	4·10
		Soda	-	-	-	3·25
Tartrate of Soda	-	-	-	-	-	0·85
						<hr/>
						100·00

Hecht\* found seventy-two grains of scirrhus breast to contain —

Albumen	-	-	-	-	-	2 grains.
Gelatine	-	-	-	-	-	20 "
Fibrin	-	-	-	-	-	20 "
Fluid fatty matter	-	-	-	-	-	10 "
Water	-	-	-	-	-	20 "
						<hr/>

Seventy grains of scirrhus uterus were composed of —

Gelatine	-	-	-	-	-	15 grains.
Fibrin	-	-	-	-	-	10 „
Fatty matter	-	-	-	-	-	10 „
Water	-	-	-	-	-	35 „
						<hr/> 70

By comparing the above analysis of Hecht with that of Foy, it will be perceived that it exhibits striking peculiarities, consisting mainly in the presence of a considerable quantity of gelatine, in the small proportion of albumen, and in the entire absence of inorganic salts. It will also be noticed that the results obtained by Hecht in his two examinations differ remarkably from each other. Thus, in his first analysis, albumen is enumerated as one of the ingredients, while in the second none of this substance appears to have been detected; there was also a greater proportion of fibrin and gelatine, and a much smaller quantity of water. Müller agrees with Foy in stating that scirrhus rarely, if ever, contains any gelatine, while Morin and Collard de Martigny unite with Hecht in asserting that it is an invariable elementary principle of this deposit. On the whole, it may be fairly inferred, from the preceding statements, that the intimate composition of scirrhus matter varies considerably not only in different parts of the body, but likewise in different stages of the disease, and probably, also, in different parts of the same preparation.

Scirrhus rarely appears before *the age* of thirty, in which respect it strikingly differs from encephaloid. It is much more common in women than in men, and its favorite period of attack is from the fortieth to the fiftieth year. Rarely, perhaps never, does it occur before the period of puberty. The lymphatic temperament is said to predispose to it, and in some instances it seems to be connected with a hereditary taint, being transmitted from parents to their offspring. In the uterus, mammary gland, and testicle, it has been repeatedly observed in three or four members of the same family. Very often it supervenes upon external violence, such as a blow, kick, or bruise, syphilitic disease, suppression of the menses, and the repulsion of herpetic eruptions. In other cases, again — and these are very common — it arises without any assignable cause. Corroding cares, by impairing the general health, sometimes induce the disease; and in the female, it is often dependent upon sympathetic action between the breast and the uterus.

Scirrhus sometimes attacks a considerable number of organs in the same individual, either simultaneously, or in gradual succession. In females, it is not uncommon to find both the breast and the uterus involved at the same time. It not unfrequently coexists with encephaloid, tubercle, melanosis, and hydatids.

The parts of the body most liable to scirrhus are such as have a glandular structure. In females, it is most common in the breast and uterus; in males, in the testicle, penis, stomach, and rectum. In both sexes the lips, nose, and liver may be mentioned as frequent seats of it. The spleen, lungs, and kidneys are seldom affected. It is also extremely rare in the bones; and it is doubtful whether it ever occurs in the cartilages, in the serous, synovial, and fibrous textures, and in the muscles of voluntary life.

The mass of scirrhus consists of two distinct substances, a fibrous and a granular. The former is of a whitish, cineritious, or pale yellowish color, and is composed of a very irregular network, the meshes of which have no determinate shape or size. It constitutes the bed in which the granular element is

deposited, and is seldom very apparent until the latter has been scraped away or removed by maceration. When this has been done, its filaments are found to intersect each other in every direction, as is seen in Fig. 35, and to form the cells, meshes, or cavities, just alluded to. The fibrous element is not always a new product, but merely the remnant of the tissues in which the morbid matter is seated. In scirrhus of the mammary gland, it seems to consist mainly of the pre-existing cellular substance and the lactiferous tubes, the former of which is very much condensed, while the latter are hypertrophied and filled with a colorless, whitish or yellowish matter. In scirrhus of the liver, on the contrary, the fibrous structure is generally of new formation, just as much so as the granular element which it serves to enclose.

The granular matter is of a greyish color, and consists of loosely connected microscopical, formative corpuscles, or transparent cells, from 0.00048 to 0.00130 of an English inch in diameter. They are insoluble in acetic acid, and also in cold or boiling water. Müller\* states that many of these cells contain only a few minute granules, as in Fig. 36; while others are occupied by a larger body, which looks like a nucleus, or like a smaller vesicle, enclosed by a germinal globule. This arrangement is represented in Fig. 37.

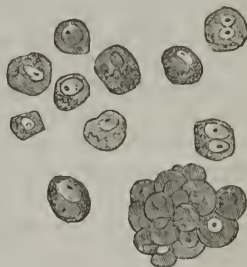
Fig. 35.



Fig. 36:



Fig. 37.



After what has been stated, under the head of the tuberoid variety of scirrhus, it will scarcely be expected that we should enter into a formal discussion respecting the mode of organization of this disease. There is one theory, however, which demands brief notice, as well from its singularity, as the high source from which it emanates. I allude to the well-known doctrine of Professor Carswell, which inculcates the strange notion, that, whilst encephaloid is capable of generating its own vessels, scirrhus is dependent for its vascular supply upon the surrounding textures. Now, if we look upon scirrhus merely as a modification of the coagulating lymph, as we certainly must if we duly contemplate its physical and chemical properties, together with its origin and mode of termination, we must ascribe to it, I think, a self-organizing power, and consequently a proper as well as a collateral circulation. It is not necessary to reiterate here what was said in reference to this subject under the head of tubercle; and I shall therefore add only one other remark, which is, that the vessels of the heterologous formation in question, whether we regard them with Carswell as being derived from the circumjacent tissues, or as created, in fact, by its own inherent powers, are always much smaller and less numerous than they are in encephaloid, being so extremely fine and delicate, in most cases, as to escape the naked eye.

\* Op. cit., p. 43.



Concerning the *proximate cause* of scirrhus, nothing is known with any certainty, notwithstanding the numerous attempts that have been made to investigate it. By some of the older authors the disease was ascribed to the presence of worms, which, destroying the natural tissues of the part, produced, as they conceived, all the local mischief. Singular as this theory may appear, one very similar to it was broached, about thirty years ago, by Dr. Adams, of England. He contends that scirrhus uniformly depends upon the presence of a parasitic animal, to which he has given the name of the *carcinomatous hydatid*. Of this he has pointed out three varieties, — the serous, the gelatinous, and the sanguinolent—each of which is capable of exciting, as he supposes, a specific irritation in the part where it occurs, resulting in a deposition of the heterologous substance in question. This doctrine, if such it deserves to be called, has been adopted, with certain restrictions, by Dr. Richard Carmichael, of Dublin, who is still one of its most zealous advocates, as would appear from an essay which he published, a few years ago, on the “Origin and Nature of Tuberculous and Cancerous Diseases.” That such is the source of scirrhus in some cases, is not improbable; for it may be easily imagined that hydatids would excite irritation, to some extent at least, in whatever organ they occur, followed occasionally by a deposition of foreign matter. The circumstance, then, may be supposed to be within the range of possibility; that it is constant, however, as is alleged by the abettors of this theory, is an assumption which is not less opposed by analogy than it is unfounded in fact. If the doctrine were true, hydatids ought always to exist wherever there is scirrhus, which is not the case. Instead, therefore, of considering these bodies as the immediate cause of this disease, we are justified in the belief that, in the great majority of instances, they are merely accidental growths superadded to the original disorder. The late Mr. Abernethy advanced the idea that scirrhus is formed by the coagulating lymph of the blood, poured out as an effect of inflammatory irritation, whether spontaneous, or the result of external injury. He fixes its seat in different textures, as the cellular, serous, and parenchymatous, and supposes that it becomes organized, not by any vessels of its own creation, but by the assistance which it receives from the surrounding structures. This theory, though usually regarded as untenable, is not without plausibility.

Dr. Hodgkin,\* some years ago, undertook to show that all scirrhus and malignant growths are dependent upon the presence of serous cysts. These, which may be either simple or multiple, always exist, he conceives, prior to the heterologous matter, of which they consequently form at once the seat and source, or, in other words, the bed for its reception and accommodation. The number of cysts is variable; some specimens are almost entirely composed of them, while in others they are so rare and indistinct that it is difficult to detect them. They are generally very small, and of a globular shape; but occasionally they are pyriform, or pediculated. Their contents vary from a fluid that is perfectly clear and limpid to a substance that is more or less opaque and solid.

The paper of the English anatomist, of which the above is an imperfect summary, appeared in 1829. Since that period he has published another elaborate and highly interesting inquiry,† in which he reiterates his conviction of the cystiform origin of carcinoma. “Continued observation,” he remarks, “has confirmed the constant presence of the type of compound serous cysts in a class of adventitious structures, which comprehends the whole family of can-

\* Medico-Chir. Trans. of London, vol. xv, p. 265, 1829.

† Ibid., vol. xxvi., p. 242, 1843.

cerous diseases. I may add, that I have found it, not only in man, but also in the inferior animals, as, for example, the horse, the ox, the cat, and different species of birds." The theory of Dr. Hodgkin is unquestionably very ingenious, but not, on this account, as I conceive, any the less untenable. Carcinomatous, like all other organizable matter, whether natural or adventitious, is a product of secretion; its elements exist in the blood; and it is always effused in an amorphous, structureless state. It soon, however, assumes a more definite arrangement, and is successively converted into granules, nuclei, and cells, or cytoblasts. Serous cysts are undoubtedly often associated with it; but to maintain that the coexistence is constant, and that the former of these structures invariably exercise a formative function, is a conclusion which is not warranted by the present state of the science.

It has been already seen that the matter of scirrhus is closely allied to that of tubercle, both in its color, its consistence, and, above all, in its chemical composition. Indeed, no one who studies the subject can help being struck with the remarkable analogy between these two heterologous formations. What the precise difference is, or where the connection begins and terminates, is unknown. A profound study of pathological anatomy, not in books, but in the dead-room, is alone competent to decide the question. Chemistry, too, must lend its aid, and lay the results of its analysis upon the altar of science.

Tubercle, as was attempted to be shown elsewhere, is always the result of inflammation; and that this is the case likewise with scirrhus, seems sufficiently evident from what has been stated in regard to its exciting causes. Very frequently, it is true, the disease arises imperceptibly, without local injury or obvious constitutional derangement. But this certainly does not prove that inflammation is not concerned in its production. How often do we not find traces of inflammation after death, without having had the slightest indication of it during life. The fact, then, that it is not manifested always by the usual phenomena, does not invalidate the idea of its presence. The opinion that scirrhus and other malignant diseases are caused by inflammatory irritation, is not new. It has been zealously inculcated by Broussais, Breschet, Sanson, and other pathologists of the French school, and has likewise received the sanction of several of the most distinguished writers of Great Britain, Germany, and Italy. The precise nature of this inflammation cannot be defined: all that can be said about it is, that it is of a specific kind, and that it gives rise to the effusion of a fluid analogous to the fibrin of the blood, and not very dissimilar, consequently, from the matter of tubercle.

The effusion thus produced takes place in the cellular element of our organs, the proper structure of which it gradually transforms, effaces, or destroys. That this is the case, is sufficiently evinced by what happens in the liver, kidney, and pancreas. Cases occasionally occur in which the heterologous substance can be discovered in different stages of its development, so as to enable us to determine the manner in which it is deposited. Thus, in the liver, the scirrhus matter generally appears in very minute, circumscribed points, corresponding with the granulations which are so abundantly found here in the natural state. At first, there is merely a change of color, the granulations exhibiting a pale greyish aspect, without the slightest deformity or augmentation of volume. At a somewhat later period, the little tumors are observed to be of a white milky hue, hard, dense, crisp, opaque, irregularly spherical, and perfectly devoid of the original structure. Now these alterations, it is quite plain, can only be accounted for on the assumption, that, in proportion as the heterologous matter is deposited into the cellular texture of the acini of the liver, their proper parenchymatous substance, whatever it may be, together

with their vessels, in obliterated by absorption, the pressure which the accidental secretion produces being fully adequate to bring about this result. Similar phenomena are to be witnessed, as scirrhus is being developed in other organs.

From the foregoing remarks, then, it may be concluded, first, that scirrhus is invariably produced by inflammation; secondly, that it has a great predilection for the glandular viscera; thirdly, that it rarely occurs under the age of thirty; fourthly, that the matter of which it consists strongly resembles that of tubercle; and, lastly, that this matter is deposited always into the cellular tissue of our organs, in such a manner as to transform their proper parenchymatous structure.

After having existed for some time, varying from a few months to several years, the scirrhus matter manifests a disposition to become soft, the process by which this is effected commencing, like that of tubercle, at different parts of the diseased mass, from which it extends in various directions, until the whole or the greater portion of it is broken up and dissolved. Some authors have contended that the liquefaction invariably begins in the centre; but that this is not true, my own experience abundantly attests. The process, in fact, may commence at any point, at the centre or at the periphery, or simultaneously in both these situations; and, as it advances, the superincumbent integuments crack at one or more places, through which the softened matter, now of the aspect of encephaloid, jelly, syrup, gum, or honey, is ultimately discharged. Ulceration, however, often occurs in scirrhus tumours long before the internal disorganization in question is accomplished.

A scirrhus ulcer possesses certain features which may be considered as characteristic. Generally, it is remarkably irregular in its shape, with a surface that is either cracked, fissured, or fungous, of a dark, reddish color, and of a peculiar glossy, œdematous aspect. Soft cauliflower excrescences sometimes sprout from it, so sensitive as to bleed on the slightest touch, or even of their own accord. The edges of the sore are of a reddish grey color, elevated, everted, irregularly serrated, and harder in some places than in others, emitting more or less sanies on pressure. A deep excavation is occasionally formed, presenting the appearance as if a portion of the diseased mass had been lifted out of its bed. In cases which run their course very rapidly, the surface of the ulcer is frequently covered with a soft, greyish putrilage, of the most intolerable odor.

The fluid which bathes the surface of the ulcer, is generally of a thin, bloody, ill-conditioned nature, with an odor approaching that of ammonia. It is always highly irritating, and the quantity discharged is sometimes surprisingly great. Dr. Crawford, an English physician, who has particularly examined this fluid, states that it blackens silver, and imparts a green color to syrup of violets. Potash produces no change; but, on the addition of sulphuric acid, a peculiar gas is evolved, having many of the properties of sulphuretted hydrogen. This gas appears to exist in union with ammonia, and gives the fluid its peculiar fetid odor.

In this advanced stage of the disease, the skin around the ulcer is of a purple color — from the overloaded state of its capillaries — hard, puckered, somewhat tender on pressure, and easily eroded by the irritating discharges. By degrees, the ulcer spreads both in depth and diameter until at length the whole mass is involved in the disorganizing process, and the patient sinks under the exhausting hectic, caused by the profuse local discharges, and by the violent constitutional irritation. The lymphatic ganglions in the neighborhood at this advanced stage are almost constantly enlarged and indurated, and the tumor,



instead of being movable and circumscribed, as it was in the early period of its growth, forms a hard, solid, undefined mass, firmly adherent to the surrounding structures.

Scirrhus is recognized by its circumscribed character, its hardness and incompressibility, and by the peculiar nature of the accompanying pain. The hardness is greater than that of any normal texture, save the cartilaginous and osseous. The pain is usually of a gnawing, lancinating kind, darting through the swelling in different directions, and coming on in irregular paroxysms, which, as the disease progresses, increase both in frequency and violence, as well as in duration. Sometimes it is prurient, hot, burning, or scalding, and is then commonly more permanent. At first, the tumor is movable, distinctly circumscribed, and the skin over it perfectly natural; by and by, however, it contracts adhesions, and soon becomes fixed and less defined, at the same time that its cutaneous covering experiences various alterations, both as respects its smoothness, its color, and its consistence. These remarks, of course, apply solely to external scirrhus growths: when seated internally, the diagnosis is exceedingly difficult, and only to be effected by the nicest discrimination.

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#### SECTION IV.

##### ENCEPHALOID.

Intimately allied to scirrhus, in its mode of origin, yet differing from it widely in many of its essential features, is encephaloid, one of the most formidable and destructive of the heterologous formations. As the term indicates, this morbid growth bears a great resemblance to the cerebral tissue, not only in appearance, but also in chemical composition. For the first accurate account of it, we are indebted mainly to Mr. John Burns, of Glasgow, who described it under the name of spongoid inflammation. The observations of this eminent surgeon soon attracted the attention of other pathologists, both in Great Britain and on the continent of Europe, and, as might have been expected, led to further and more thorough investigation. Amongst those who have particularly distinguished themselves in this respect, may be mentioned the names of Hey, Abernethy, Wardrop, Laennec, Roux, Maunoir, and Carswell. Most of these writers designate the disease by a different appellation, according to the peculiar notions which they entertain of its composition and structure. Thus Abernethy calls it medullary sarcoma; Hey, fungus hæmatodes; Roux, soft cancer; Maunoir, medullary fungus; and Mr. Burns, as already stated, spongoid inflammation. The term encephaloid, devised by Laennec, seems, on the whole, less objectionable than any other, and I shall therefore retain it on the present occasion.

Encephaloid, compared with some of the other heterologous formations, is a very frequent disease, occurring in both sexes and at every period of life. It is not peculiar to the human subject, but is occasionally witnessed in the inferior animals, especially the horse, ox, and dog. It may exist alone, or be associated with tubercle, scirrhus, melanosis, hydatids, and other growths. The foreign matter is deposited in the different organs in three distinct varieties of form, — the tuberoid — the stratiform — and the infiltrated.

In the tuberoid *variety* (Pl. IV., Fig. 1) the heterologous matter appears in



Plate IV.

Fig 1. Tuberiform v



Fig 2. Pedunculated v

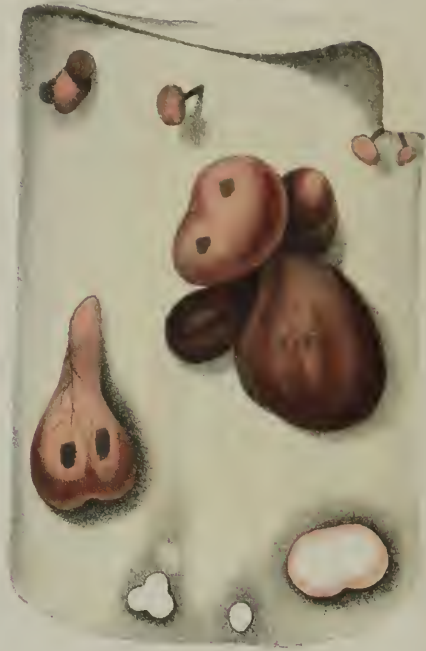


Fig. 3. Stratiform v.

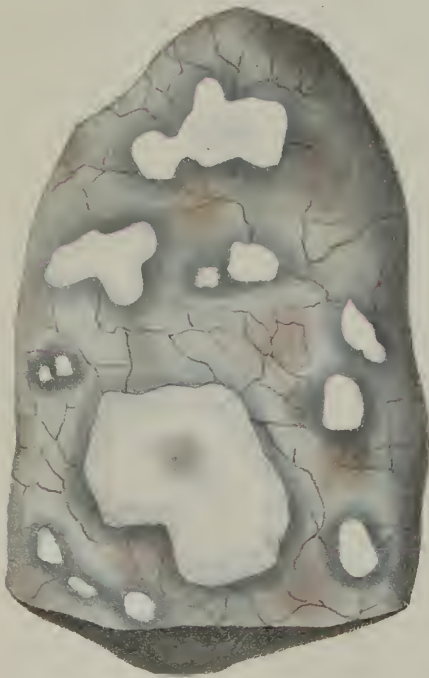


Fig. 4 Infiltrated v









the form of a circumscribed tumour, from the size of a pea to that of an adult head. In its shape it is generally irregularly rounded, ovoidal, or even quite flat, according to the amount of pressure exerted upon it by the surrounding parts. It is composed of different lobules, which are enveloped by a thin covering, and separated from each other by delicate membranous partitions. The outer covering, evidently derived from the neighboring cellular tissue, is usually not more than half a line in thickness, easily torn, semi-transparent, and of a light rose color. From its inner surface are detached numerous processes, which, dipping into the morbid growth in various directions, form so many cavities for the reception of the new deposit. These septa, which are sometimes remarkably rough and shreddy, always become more obvious after the pulpy mass is squeezed out. The cells which they form by their intersections are subject to much variety, and hence the peculiar lobulated shape which characterizes the morbid growth when occurring in parts that offer little or no obstacle to its extension.

Although the covering of encephaloid tumors is ordinarily derived from the pre-existing structures in their immediate vicinity, yet cases occasionally occur in which it is evidently of new formation. That this is true, my own dissections fully convince me. In such cases, the external envelope is generally very thin; sometimes, indeed, almost like a film, easily lacerated, and of a greyish color, with rough, shreddy surfaces. The interior septa are likewise less perfect, and the whole mass is commonly so soft as to yield to the slightest force.

The external envelope, together with the internal processes here described, is abundantly supplied with vessels which pervade the diseased mass in different directions, assist in its growth, and maintain its vitality. These vessels, which always consist of a much greater number of veins than of arteries, are often remarkably large, convoluted, and easily traced to the neighboring trunks: their walls are exceedingly brittle, and the most trifling accident is liable to be attended with effusion of blood. Hence the dark clots which are so frequently met with in encephaloid tumors. The cerebriiform substance itself is easily squeezed out of its cavities, owing to its imperfect adhesion; and, interspersed through different parts of it, we frequently observe, besides the sanguineous deposits just adverted to, small cells filled with purulent matter, serum, or thin, sanious, and offensive fluid. In one case, I saw as much as half a pint of reddish serosity flow from a single cavity, the inner surface of which had a peculiar honeycomb-like appearance.

When developed beneath the pleura and peritonæum, these tumors generally assume a pear-shaped appearance, the footstalk, by which they are attached, being often quite slender. (Pl. IV., Fig. 2.) In their volume they vary between that of a pea and a walnut: they are of a dirty straw color, and of a semi-concrete consistence. Although usually isolated, they sometimes occur in groups, and are always distinctly encysted, the capsule which covers them being either of new formation, or, as more frequently happens, derived from the serous membrane beneath which they are developed. This variety of encephaloid is uncommon.

The *stratiform variety* (Pl. IV., Fig. 3) is exceedingly rare; I have not met with it except in a few instances. It is found only in the subserous cellular tissue, principally in that of the pleura and arachnoid, in circular patches, from the diameter of a pin-head to that of an American dollar. The deposit is generally of a whitish, cream-like color, tolerably hard and dense, and from the fourth of a line to the twelfth of an inch in thickness. Several such patches occasionally run together, and thus form an irregular layer of



considerable extent, over which the serous membrane is indurated and puckered.

The encephaloid matter sometimes occurs as an *infiltration*. (Pl. IV., Fig. 4.) This variety, which is likewise very uncommon, is seen principally in the uterus, liver, and lungs, where it forms small, irregular masses, of a semi-concrete consistence. In the situations here referred to, the heterologous substance usually partakes more or less of the color of the parts in which it is deposited, and is often distinguished with difficulty from the tubercular infiltration described in a previous section.

The *color* of the heterologous substance although generally inclining to cineritious, runs through various shades of white and red, having either the yellowish aspect of cream, the complexion of jelly, or the black appearance of the crassamentum. In the tuberoid species, it is not unusual to see different sections of the morbid mass present different shades of color, one part being pale, another cineritious, and a third of a deep brown, from the intermixture of clotted blood. It is seldom that the tumor has the pure white aspect of the medullary substance of the brain.

The *consistence* of this heterologous growth is also subject to much variety. Though in general pretty nearly that of the fetal brain, it is sometimes as soft as cream, and at other times as hard as fibro-cartilage. Like the tubercular matter, it is supposed by Laennec, Lobstein, and others, to be originally deposited in a concrete state. But for this opinion there seems to be no just ground; and I feel disposed, therefore, to reject it, the more so as it cannot be supported even by a single argument from analogy. The error into which these anatomists have fallen, may, it seems to me, be readily explained, by the fact that the heterologous matter varies in its physical and chemical properties, not only in the different organs of the body, but often in different sections of the same mass. Thus, we frequently find encephaloid tumors hard and lardaceous in one part, semi-concrete and medullary-looking in a second, pulpy and cineritious in a third. That these differences of consistence, as well as of color, are the result, in some degree at least, of changes effected in the morbid substance after the deposition has taken place, cannot be doubted. We may therefore say of this matter as we previously did of the tubercular, — that it is never poured out in any other than a fluid state, whatever may be its consistence at the time it is examined, whether concrete, pulpy, or semi-liquid.

The structure of encephaloid, as just stated, is not always the same; on the contrary, it is often very much diversified, and is therefore usually arranged under different heads, as constituting so many varieties. Of these, the most common is the *hæmatoid*, or that form of it which was originally described by Mr. Hey, of Leeds, under the name of fungus hæmatodes. In this variety the morbid structure bears the closest resemblance to the placenta, or to a mass of coagulated blood; it is of a brownish, mahogany, or pale brick color, extremely friable, and composed of small, intertwined vessels and cellular tissue, or of an amorphous, or laminated substance, not unlike the crassamentum, or a recent fibrinous concretion. In some instances the heterologous deposit has a granular appearance. It is always contained in distinct cells, of a rounded or oval shape, from the size of a billiard-ball down to the head of the smallest pin. These cells generally communicate with each other, and are formed by a fibrous network, which is either a new development, or composed of the pre-existing textures.

This variety of encephaloid is generally lobulated, and may consist almost entirely of hæmatoid substance; it is compressible, and slightly elastic, has a solid feel, offers little resistance to the knife, and the cut surface has a uniform

red or mottled appearance, like the section of the placenta, or a calf's liver. The outer surface of the tumor may be perfectly smooth, or rough and shaggy; the latter character is often rendered very conspicuous after maceration for a day or two in water. The hæmatoid tumor is exceedingly vascular, and frequently attains a very large bulk. It is sometimes invested by a distinct capsule, either of new formation, or, as is more generally the case, derived from the surrounding parts; and interspersed through it are occasionally dots of extravasated blood, or, cells filled with various kinds of matter. The most common seats of this growth are the mammary gland, the lymphatic ganglions, the eye, brain, and liver. In the latter organ it sometimes exists in considerable numbers, from the volume of a grain of mustard to that of an orange, and composed entirely of a red, bloody, semi-concrete substance, easily enucleated from the containing bed.

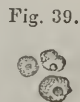
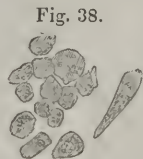
The cerebriform matter may be quite hard, inelastic, or nearly so, white, and perfectly uniform when cut, like the interior of a potato. When this is the case, it constitutes what Recamier has called the *solanoid* variety of cancer. The morbid growth may also resemble the structure of the kidney, and is then termed *nephroid*. "When the fibrous intersections are distinct, broad, and fascicular, the divided mass has more the appearance of a cut turnip, and is therefore called *napiform* by this pathologist. This latter condition is, however, much more frequent in true fibrous tumors."\*

Müller, in his recent work on cancer, has described a variety of encephaloid under the name of *hyaline*, in reference to its transparent, vitreous appearance. This character, however, is not constant, and the term *fasciculated* is therefore preferable. The form of the disease is not very common, and is often with difficulty distinguished from the reticulated variety of scirrhus described in another page. It seems to resemble, in its general features, the nephroid cancer of Recamier. The tumor is highly vascular, and is composed of extremely pale, transparent fibres, which follow no fixed direction. The fibres are often arranged in tufts, which are intertwined with each other, and give the morbid mass a lobulated aspect, both externally and in its interior. Under the microscope, this growth presents neither the cell-globules of the other varieties of carcinoma, nor the caudate corpuscles of apparently fibrous encephaloid. From its unusual vascularity, hyaline cancer occasionally acquires a large bulk.

Encephaloid tumors, apparently quite similar in their physical and chemical properties, frequently exhibit, on *microscopical* inspection, marked peculiarities, entitling them to be considered as distinct varieties. Of these, not less than three have been recognised by Müller.

1. In the first variety, the morbid substance abounds in roundish formative globules, intersected by a delicate, fibrous network, in the meshes of which they are situated. Their form is very irregular, but inclining to the circular, and the smallest are the  $\frac{1}{125}$ th of a millimeter, or 0.039370 of an English inch in diameter; their surface is uneven, punctuated and marked with blackish lines. Müller regards the globules as very similar to those of common scirrhus; minute granules are often detected in their interior, and with a strong magnifying power a nucleus may also be discerned, just as in other forms of carcinoma. These appearances are exhibited in Figs. 38 and 39.

2. The encephaloid matter consists of caudate or spindle-shaped corpuscles,



\* Walsh, article Cancer, Cyclop. Pract. Surgery. vol. i. p. 597.

as seen in Figs. 40, 41, and 42. The fracture of the tumor is fibrous, radiated, or tufted, according to the arrangement of the caudate bodies, which is

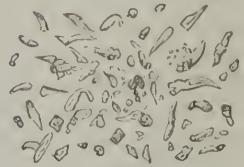
Fig. 40.



Fig. 41.

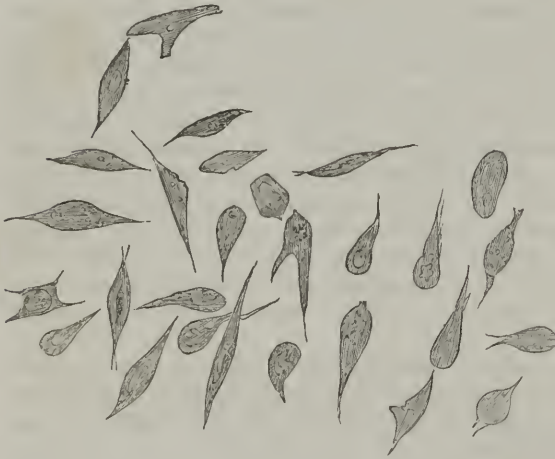


Fig. 42.



frequently very irregular. In some specimens the linear disposition is wanting.

Fig. 43.



The caudate bodies contain either a granular substance without any evident nucleus, or a nucleus with one or more nucleoli. Their sides are prolonged into fibrils, or filaments, as represented in Fig. 43.

3. The morbid mass is characterized by the presence of pale, elliptical bodies, without caudate appendages. This variety was seen by Müller only once, and may therefore be regarded as extremely rare. With the exception of the vessels which were distributed through the tumor, the cerebriiform sub-

stance was almost entirely composed of these bodies, which had very little connection with each other, and were about twice as large as the globules of the blood. No fibrils issued from their sides, nor did they ever contain any nuclei or young cells. With the highest magnifying instrument, a few dark points only were detected. These appearances are shown in Fig. 44.

Fig. 44.



Encephaloid matter, freed from the cellular structure in which it is contained, and before it has passed into its crude state, is of a viscid, jelly-like consistence, emits a peculiar spermatic odor on being heated, and readily coagulates in alcohol, in the acids, and in a solution of corrosive sublimate. It is miscible with water, and gradually liquifies when exposed to the action of the air.



The *chemical characters* of this substance have been investigated by Hecht, Morin, Collard de Martigny, Wiggers, and Foy; the latter of whom has published the subjoined quantitative analysis:

Albumen	-	-	-	-	-	47.00
White fatty matter	-	-	-	-	-	7.50
Red fatty matter	-	-	-	-	-	5.35
Osmazome	-	-	-	-	-	4.00
Fibrin	-	-	-	-	-	6.50
Water	-	-	-	-	-	8.00
Oxide of iron	-	-	-	-	-	1.35
Sub-phosphate of lime	-	-	-	-	-	6.30
Carbonates of	{ Soda	-	-	-	-	2.75
	{ Lime	-	-	-	-	4.00
	{ Magnesia	-	-	-	-	1.00
Hydrochlorates of	{ Potassa	-	-	-	-	2.70
	{ Soda	-	-	-	-	2.00
Tartrate of Soda	-	-	-	-	-	0.35
						<hr/>
						100.00

Compared with the analysis of scirrhus by the same chemist, the chief peculiarities here are the presence of osmazome, and the lesser quantity of inorganic salts. The fibrin exists nearly in the same proportion, while the amount of albumen and fatty matter is considerably greater. Foy and Maunoir have never found any gelatine in this substance; and Müller also observes that, except in one case of encephaloid of the kidney, he never detected any notable quantity of that principle, even after subjecting the morbid matter to the most protracted boiling. On the other hand, Hecht, Morin, Wiggers, and Collard de Martigny, all agree in enumerating gelatine among the constituents of this morbid product. The first of these chemists appears to have found it entering very abundantly into the composition of crude specimens, and albumen into that of softened, while fat occurred in neither.\* Phosphuretted fat has been discovered once in this species of growth by Wiggers; cholesterine by Gugert; and casein by Müller.

Concerning the mode of *organization* of this substance, especially the tubercloid variety, we have already made some remarks; it will only be necessary, therefore, in connection with the subject, to advert briefly to the ingenious doctrine recently advanced by Professor Carswell. This distinguished anatomist supposes that encephaloid matter, like plastic lymph, is always endowed with a high degree of vitality, in virtue of which it is qualified to form its own vessels. These, it is contended, often arise in the midst of the morbid deposit, from whence they gradually extend towards its circumference, where they finally anastomose with the arteries and veins in their immediate vicinity. If this view be adopted — and I see no particular objection to it — encephaloid will be found to have two circulations, one proper to the diseased mass, the other common to it and the surrounding structures. Owing to this peculiarity of its vascular system, it often grows with great rapidity, so as to attain a frightful magnitude in the course of a few months. For the same reason it is very prone to bleed; the new vessels, which are usually very imperfectly organized, being exceedingly liable to be ruptured on the slightest injury. Nerves probably exist in considerable abundance in encephaloid, though it is a sin-

\* Cyclopædia of Surgery, vol. i., p. 595.

gular fact that this disease is generally much less painful than scirrhus. Whether they are of new formation, or derived from the tissues in which the morbid growth is developed, is a point for the determination of which we have no data.

How does this substance *originate*? Desirable as it would be to give a satisfactory solution of this problem, it must be confessed that any attempt of the kind would be likely, in the present state of the science, to prove abortive. The opinion of Dr. Maunoir, of Geneva — that the encephaloid matter is effused by the nerves under the influence of some peculiar morbid state — although highly ingenious, is entirely unsupported by facts, and cannot, therefore, receive the sanction of the pathologist. The circumstance that this substance has been found in the blood, is of no small moment in the discussion of this question. It would lead to the inference that, when the sanguine fluid is surcharged with it, the cerebral matter, instead of being deposited in the brain, spinal cord, and nerves, is poured out in the meshes of the cellular element of one or more of the organs of the body. This conjecture is so much the more plausible, as encephaloid disease often arises without any assignable cause, is sometimes decidedly hereditary in its tendency, and almost always exists in several situations at the same time. Chemical analysis, also, comes to our aid here, bringing to light the important fact that the cerebral tissue and the heterologous deposit are essentially alike in their character. Nor is analogy without its utility in a discussion of this kind. Cholesterine, the crystalline matter which constitutes the basis of biliary concretions, is frequently formed in parts of the body which have no connection whatever with the hepatic circulation, in consequence merely of deranged vascular action. Christison found it in the fluid of hydrocele; Breschet, in a tumor under the tongue; Caventou, in an abscess of the jaw; Barruel and Rees, in an ovarian cyst; Bostock, in a diseased thyroid gland. Thus we see that a substance which is naturally confined to one organ may, by a perversion of the secretory function, be deposited in another, totally unlike it in structure and office. Similar illustrations, it is obvious, might be adduced from other parts of the body.

Encephaloid has been found in various organs at every *period of life*. It occasionally makes its appearance soon after birth, and it has also been seen as an intra-uterine affection. On the other hand, it may manifest itself at a very advanced age. The following table, compiled for me by my friend, Dr. Cassot, a graduate of our school, tends to show that the disease is most frequent between the twenty-first and fortieth years. It is founded on an analysis of one hundred cases, in nine of which, however, the age is not mentioned.

TABLE I.

Years.						Number of cases.
1—3	-	-	-	-	-	8
3—7	-	-	-	-	-	4
7—14	-	-	-	-	-	5
14—21	-	-	-	-	-	9
21—30	-	-	-	-	-	20
30—40	-	-	-	-	-	14
40—50	-	-	-	-	-	18
50—60	-	-	-	-	-	7
60—70	-	-	-	-	-	4
70—75	-	-	-	-	-	2
Age not specified	-	-	-	-	-	9

In the eye encephaloid occurs most frequently in childhood. I have seen at least a dozen examples at this period, and in seventeen cases mentioned by Mr. Wardrop, only two were above twelve years of age. Mr. Middlemore declares he has never seen fungus hæmatodes of the eye after the fifth year. In fact, there is reason to believe, from the testimony of numerous observers, that at least five-sixths of those who die of this disease in this organ are cut off in childhood. On the other hand, encephaloid of the liver, lungs, brain, testicle, mammary gland, ovary, uterus, bones, and lymphatic ganglions is more frequently noticed in manhood, adolescence, and old age, than at any other period.

The relative frequency of the disease in the *two sexes* has not been ascertained. Of the cases analyzed by Dr. Cassot, sixty-two were males, and thirty-six were females; in two, the sex is not specified. In my own practice I have seen the disease oftener in women than in men. Of the influence of temperament, climate, and occupation in the production of encephaloid, our knowledge is altogether theoretical. The same remark is true in regard to the hereditary transmission of the disease from parents to their offspring.

The *site* of encephaloid is a circumstance deserving attention. The parts most frequently affected are the eyes, bones, testicles, liver, lymphatic ganglions, and subcutaneous cellular tissue. Scarcely a single organ, however, is entirely exempt from its attack. It has even been noticed in the veins, especially in those of the liver, kidney, and uterus; and in many instances it is ingrafted upon polypous and other growths. The following table, constructed by Dr. Cassot, gives a view of the localization of the disease in different structures in one hundred cases.

TABLE II.

Skull - - - -	3 times.	Groin - - - -	3 times.
Eye - - - -	10 „	Thigh - - - -	8 „
Face - - - -	3 „	Knee - - - -	8 „
Neck - - - -	4 „	Leg - - - -	4 „
Shoulder - - -	3 „	Surface of the body -	1 „
Interscapular region -	1 „	Fauces and larynx -	1 „
Axilla - - - -	6 „	Lungs and thoracic cavity	4 „
Fore-arm - - -	5 „	Liver and abdominal cavity	9 „
Hand - - - -	1 „	Uterus and pelvic cavity -	3 „
Mammary gland - - -	6 „	Penis - - - -	1 „
Chest - - - -	1 „	Scrotum and testicle -	14 „
Abdomen - - - -	1 „		
			<hr/> 100

It is very common to observe the successive or simultaneous development of this disease in a number of organs or parts. In fact, there is occasionally a marked encephaloid diathesis. The celebrated case narrated by Velpeau powerfully illustrates this position. In this instance the common cellular membrane, the muscles and bones, the lungs and heart, the tissue between the costal, pleura and ribs, the stomach, duodenum, and small intestines, the pancreas, kidneys, liver, vena cava, and coats of the gall-bladder, the peritonæum, dura mater, and the thyroid gland, were all in various degrees affected with the disease.\*

\* Cyclopædia of Surgery, article Cancer, p. 597.



Another remarkable feature of encephaloid is its disposition to *reappear* after extirpation, within the original seat, in the structures immediately around, or in remote parts. This is not surprising when we consider, as unquestionably we must, that this disease is of constitutional origin, and that the deposits to which it gives rise are merely so many local manifestations of its presence in the system. In what degree the blood is disordered in this affection, or in what respect it favors the heterologous formation, is a circumstance concerning which we are entirely ignorant. An interesting case of encephaloid, well calculated to illustrate this renovative tendency, is detailed by Mr. Allan, of Edinburgh.\* The patient suffered during thirteen years from a very large tumor which occupied the left hip, and was operated upon not less than five times by different surgeons. Within several months after each extirpation, the disease usually reappeared, and soon attained the volume of a child's head. A similar case has been observed by my friend Dr. Buchanan, of Nashville, and is related in the eighth volume of the *Western Journal of Medicine and Surgery*.

Encephaloid disease, after having attained a certain development, may remain stationary for years, unaccompanied by the slightest uneasiness, until the part receives some injury, when it often grows with frightful rapidity. When seated in the subcutaneous cellular tissue, the tumor that is thus formed is at first quite movable, smooth on the surface, and devoid of sensation; but gradually, as the enlargement progresses, it becomes stationary, irregularly lobulated, elastic to the touch, and more or less painful. If allowed to proceed, the diseased mass has a tendency to open and protrude, generally by ulceration, sometimes by sloughing, and occasionally by the bursting of an abscess situated in its interior. In either case, the exposed surface presents a dark reddish fungous appearance, is highly sensitive, extremely vascular, very prone to hemorrhage, and constantly bathed with a thin, fœtid, irritating, sanious fluid, the quantity of which is sometimes quite profuse. In many instances pure blood is effused, caused by a rupture of some of the vessels of the morbid growth; and this may be so obstinate and copious as gradually to destroy the patient. Occasionally there is a discharge of thin, glairy fluid, resembling the white of egg. Such sores, besides being always highly disagreeable, never heal, from the inability of the parts to form healthy granulations. Sometimes the ulcerated mass sloughs as completely away as if it were dissected out; but these cases are uncommon, and are soon followed by a reproduction of the heterologous substance.

Obstinate hemorrhage is most apt to occur in such tumors as are of the class to which Mr. Hey applied the term *fungus hæmatodes*. In the eye, for example, much more frequently than elsewhere, the morbid growth, if permitted to go on unrestrained, is extremely prone to bleed. The reason of this is obvious. The diseased mass is almost always composed, in part, of a vascular, erectile tissue, interspersed with encephaloid matter, and hence, as soon as ulceration sets in, hemorrhage, occasionally to an alarming and even fatal extent, is the consequence. The eroded surface, in these cases, is pale, livid, or of a mahogany color, and studded with large fungous excrescences, so grouped together as to resemble a cauliflower.

In this advanced stage of the disease, there is a rapid failure of the strength, the flesh wastes, the appetite declines, the patient is harassed with hectic fever, and the countenance assumes a peculiar yellowish, cadaverous hue. The lymphatic ganglions in the neighborhood meanwhile become enlarged, and con-

\* *Surgery*, vol. i., p. 264.

verted into a substance resembling that of the original tumor. Two modes of explanation may be offered to account for this phenomenon. The one supposes that these bodies are affected merely sympathetically, in consequence of which their vessels pour out encephaloid matter; the other, that this substance is carried to them by absorbent vessels coming from the affected part. Although this enlargement of the lymphatic ganglions seldom occurs before ulceration sets in, yet, in a few instances, I have known it to exist at an early period after the development of the heteroclite mass, a good while before the skin covering it manifested a disposition to give way.

The diagnosis of an encephaloid tumor can, in general, be easily determined by its history, consistence, and situation. In most instances, as has been already stated, the morbid mass is soft, elastic, and slightly fluctuating, with an irregularly lobulated surface. The skin exhibits a peculiar glossy aspect, and the subcutaneous veins are enlarged, tortuous, and of a beautiful bluish color. The pain that attends it is extremely uncertain, being sometimes scarcely perceptible, at other times very severe, sharp, and lancinating.

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## SECTION V.

### COLLOID.

A morbid product, consisting of a dense, fibrous, areolar structure, and of a soft, transparent, glue-like matter occupying its cells, was first described by Laennec, in the early part of the present century, under the appellation of colloid. Cruveilhier, who has given a short account of it in his work on *Pathological Anatomy*, has applied to it the term areolar gelatiniform cancer; Müller calls it alveolar carcinoma; and Hodgkin has mentioned it under the name of gum cancer. I shall employ the word colloid as more convenient and as at least equally, if not more, expressive of the true nature of the disease.

By some this heterologous formation is regarded merely as a modification of the carcinomatous products already described. Thus, Carswell alludes to it under the head of scirrhus, or hard cancer, while Hodgkin declares that, if it be not identical with encephaloid, it bears the closest relation to it. Whether these eminent pathologists are correct or not in thus classifying this morbid product, it is not my business to determine; I can only say that a careful examination of it, as it has presented itself to me in several preparations in my possession, has convinced me that it has sufficiently distinctive features to entitle it to separate consideration.

Colloid is composed of two distinct elements, bearing to each other the relation of containing and contained parts, and differing, consequently, very widely in their physical and chemical properties, as well as in their origin and mode of arrangement. The first may be considered as the fundamental structure, the base, or framework, inasmuch as it gives form and solidity to the whole mass. It is made up of a fibrous tissue, hard, firm, slightly elastic, and of a dull whitish, or pale greyish color, the band-like filaments of which intersect each other in every direction, so as to enclose areolæ, cells, or spaces, calculated to contain the jelly-like matter that is deposited within them. The vacuities thus formed present every intermediate size, between a grain of sand and a common marble. In a specimen in my possession the smallest cells

are hardly as large as the most delicate pin-head ; some are as big as peas, and a few are of the volume of a Lima bean. In their figure they are rounded, ovoidal, or angular ; many of the most capacious are multilocular, or divided by their fibrinous septa into different compartments. In regard to their number, the loculi are too variable to admit of any definite statement. Hundreds frequently exist upon a surface not more than an inch square, and, in masses of large size, the probability is that there are myriads, many of them so minute as to be invisible with the naked eye.

The cystiform structure now described is easily recognised in all specimens of the disease, and constitutes, in fact, one of its distinguishing anatomical peculiarities. The cells are lined by a thin, transparent membrane, more delicate than the pulmonary pleura, smooth on its inner surface, and intimately attached by the other to the surrounding parts by short, dense, cellular substance. This lamella is evidently of a serous nature, but differs from a natural sac of that name in being perforated at one or more points, so that a probe may be readily passed from one cell into another. In the large cavities the inner surface of the cyst has sometimes a wrinkled or corrugated appearance, especially when it is partially collapsed. Very few, if any, of the loculi, so far as my observation extends, are completely shut, and hence a colloid tumor may be said to bear a very close resemblance to a sponge, the cells of which communicate every where with each other. The vesicular and tuberoïd arrangements of colloid are exhibited in Figs. 45 and 46.

Fig. 45.



Fig. 46.



The recent observations of Müller\* on the microscopic elements of the fundamental portion of colloid, tend to show, what, indeed, is sufficiently apparent to the unassisted eye, that this substance consists of a series of decreasing cells

\* On the Nature and Structural Characteristics of Cancer, Translated by Charles West, M.D., p. 54. London, 1840.



— primary, secondary, and tertiary — encased the one within the other, and surrounded by fibrous walls of variable thickness, but always more distinctly marked in proportion to the dimensions of the cavity. Even in the smaller loculi, however, the opaque, yellow, parietal investment is usually quite apparent. Many of the areolæ contain free nuclei, as cytoblasts, or germs for the development of new cells. In order to distinguish the manner in which the cells are encased within one another, and the relation which they bear to their nuclei, it is necessary to examine them in the earliest stage of their development, before their walls are separated into fibres. The multilocular cells observed in the heteroclite mass are formed, according to Müller, by the young cysts filling up the parent cells, and coalescing with their inner surface.

The other grand constituent of this morbid growth is an unorganizable product, the consistence of which varies from that of soft jelly, or a solution of starch, isinglass, or arrow-root, to that of custard, half-dissolved glue, or semi-concrete albumen. It is generally of a pale straw color verging on green, perfectly clear, transparent, slightly tremulous, and somewhat tenacious or clammy. In the older cells it is sometimes as firm as moist cheese or the white of a boiled egg, opaque, and of a light yellowish hue, interspersed with dark points. It has also been found of a reddish color, similar to that of currant jelly, and Cruveilhier has described a variety of it which is of pearly whiteness, with a granular fracture and feel, and the chemical constitution of caseum. Whatever, however, may be its appearance or consistence, it has seldom any adhesion to the containing cyst, and is therefore always easily enucleated. It is only when the matter is very hard, or intermixed, as it sometimes is, with flakes of lymph, that it is detached or scraped away with difficulty. Müller with the aid of the microscope twice observed acicular crystals in the jelly-like matter of preparations which had been preserved in spirits of wine; and on another occasion he saw caudate corpuscles in a colloid cancer of the mammary gland.

Very little cellular substance enters into the composition of colloid. Whenever it occurs in a free state it is very short, firm, and of the same color as the fibrous septa which it serves to unite to each other and to the lining membranes of the cells. The vascular system of this morbid product has not been so thoroughly investigated as it deserves to be. That it is usually well developed, however, is apparent, not only from the large size and great number of the vessels themselves, but from the extraordinary bulk to which this cancerous formation occasionally attains. In the specimen previously referred to, vessels were seen in every direction, some of them remarkably tortuous, and from two to three inches in length by a line and a half or more in diameter. Always limited to the fibrous septa and the cysts enclosing the jelly-like matter, they exhibit the same arborescent arrangement as in the natural structures. Their walls are quite thick in proportion to their caliber, and hence they are much less liable to rupture than the vessels of encephaloid, which are generally very thin and fragile. They commonly observe a tortuous, straggling disposition, and as they pass along to their points of destination they deposit numerous twigs, which penetrate the fibrous tissue in every direction, and finally terminate in the walls of the cysts enclosing the jelly-like matter. Nothing is known with any certainty respecting the relative size and number of the arteries and veins of colloid, or the manner in which they are arranged in regard to each other. Velpeau injected a tumor of this kind before removal from the body, but was unable to detect anything peculiar in the character or mode of distribution of its vessels. Cruveilhier says that, when the disease has reached its maximum development, no trace of vascularity is discoverable; a circumstance which is extremely questionable.

Colloid is doubtless furnished with nerves and absorbents; but no attempt has yet been made, so far as I am aware, to investigate their origin and mode of distribution, the relation which they bear to the arteries and veins, or the manner in which they terminate in the cysts and membranous septa.

It would be interesting to know whether the blood-vessels, nerves, and absorbents of colloid are of new formation, coeval with the heterologous product itself; or whether they are derived exclusively, or in part, from the adjoining structures; but as the question can only be determined by further observation, it would subserve no useful purpose to discuss it in this place.

No satisfactory *analysis* has yet been made of colloid. The jelly-like matter, when freed from membranous tissue, yields no trace of gelatine, nor does it contain any casein. In the pulsatious variety, however, as it has been called by Cruveilhier, the contents of the cells, submitted to examination by Boutin-Limousineau, were found to consist of the latter substance. Occasionally albumen is present, and fresh specimens sometimes yield a little osmazome. By protracted ebullition Müller obtained a small quantity of matter, which, though somewhat allied to the salivary principle, he considers as of a peculiar nature: it was not affected by any chemical reagent, not even by tannin, and its existence was established only by evaporating the fluid in which the heterologous substance had been boiled. The jelly-like matter retains its natural transparency, color, and consistence, for a long time in spirits of wine. In my private collection is a section of a colloid tumor, which has been in alcohol since January, 1840, without having apparently undergone the slightest change of any kind. Of the fibrous element of this variety of cancer no analysis has been made.

Colloid cancer occurs in three *varieties of form*, in disseminated masses, as a distinct, solitary tumor, and as an infiltration in the substance of the part affected. Concerning the relative frequency of these varieties of form we have no positive information, but the probability is that the last is the most common.

Disseminated masses of colloid are met with in the greater and lesser omentum, the mammary gland, the testicle, and in osteo-sarcomatous tumors. They are of a rounded form, compressible and elastic, smooth, and of a pale greenish, whitish, pearly, or greyish color; they are generally about the size of currants, grapes, or marbles, and their interior is often divided into two, three, or even four lodges, or compartments. Their number varies in different instances from one to several hundred. Small bluish veins are sometimes observed on their surface. Two or more masses occasionally coalesce into a single tumor.

When occurring in the form of a solitary tumor, the colloid matter is collected into rounded masses of various sizes, agglomerated together, and united by dense cellulo-fibrous tissue. The number of tubercles may range from half a dozen or less to several thousand. The surface of the morbid mass is lobulated, botryoidal, or roughly mamillated, according to the volume and arrangement of the component cysts. Occasionally it bears a strong resemblance to the exterior of a pudding stone. The color varies with the nature of the contained matter; a pale greenish is the most usual tint; but it may be pink, bluish, yellowish, or pearly white, or all these shades may coexist in different sections of the same preparation. In its weight it ranges from a few ounces to several pounds; in its volume, from an orange to a fist, a cocoa-nut, or even an adult head. When cut, it emits a sound not unlike fibro-cartilage; it has a dense, solid feel, when deprived of its jelly-like matter, but as long as the vesicles are distended, it is rather soft, distinctly elastic, and even fluctuating, particularly over the larger cysts. A thin, delicate capsule, composed of con-

densed cellular tissue, occasionally invests the morbid mass, and isolates it from the surrounding parts. This form of the disease is most common in the peritonæum, the greater and lesser omentum, in the ovary, and in those affections of the bones known under the name of osteo-sarcoma and spina-ventosa.

In the third variety, the adventitious substance is diffused through the tissues of the affected organ, which it gradually subverts, so that in time it loses all trace of its primitive organization. The cysts are usually very small, frequently not larger than grains of sand or mustard seeds, and the jelly-like matter, generally of a pale bluish tint, also exists more sparingly than in the other forms of the disease. When an organ, as, for example, the stomach, is transformed into this substance, it almost always retains its shape, however much it may be changed in its size and consistence. The most common seat of the infiltrated variety of colloid is the stomach, but the disease has also been observed in the small bowel, rectum, omentum, and the inferior extremity of the uterus.

The *quantity* of the heterologous matter is extremely various, and is greatly influenced by the nature of the part in which it is deposited. In the bones and on the free surfaces of the serous membranes it often acquires considerable bulk, owing to the slight resistance opposed to its extension. I am now speaking, not of individual tubercles, but of aggregated masses, formed during the progressive development of the disease. The former, as was before stated, are generally very diminutive, while the latter frequently equal the volume of an orange, a fist, or even of the head of an adult. Mr. Walshe\* alludes to a colloid tumor of the omentum as large as a cocoa-nut, contained in the collection of King's College, London. Andral† describes one, removed by Roux from a man fifty years of age, which weighed nearly nine pounds. Velpeau has likewise seen large masses of this kind in the extremities. The most immense colloid tumor, however, of which I have any knowledge, fell under my observation in January, 1840, in a man forty-nine years old, whose body I examined along with Dr. Mason, of Cincinnati. It extended from the pelvis to the liver and diaphragm, surrounded the colon and part of the stomach, and concealed from view nearly the whole of the abdominal viscera. Its thickness was from two and a half to three inches; in length it measured nearly one foot, and in breadth more than eight inches. Its weight was estimated at twenty-five pounds. It was composed of thousands of agglomerated masses, from the size of a grain of mustard to that of a hickory-nut, and seemed to have been developed in the peritonæum, or in the great omentum, the latter of which was completely effaced. The liver was smaller than natural, probably from the pressure exerted upon it by the tumor, but in other respects it was perfectly sound, as were likewise the other viscera, both abdominal and thoracic. The disease was first noticed in July, 1837, as a small, hard, circumscribed tumor, just above the pubis.

Large colloid tumors are sometimes developed in the bones, and likewise, though more rarely, in the ovary. In the alimentary canal the disease frequently occupies a large extent of surface. In the stomach, for which, in common with scirrhus and encephaloid, it seems to have a marked predilection, it often spreads over one-third, one-half, or even two-thirds of its walls, transforming them into thick, solid masses, of a dense, gristly consistence. In the rectum, colon, and small bowel, its limits are generally more circumscribed.

\* Cyclopædia of Surgery, vol. i., p. 602.

† Path. Anatomy, p. 1, p. 208.



The *seat* of colloid, at least if we may judge from our present knowledge of the subject, appears to be much more limited than that of the other cancerous productions. The structures which are most liable to it are the alimentary canal, particularly the stomach and rectum, the omentum, ovary, lower jaw, and bones of the extremities. It has also been noticed, though rarely, in the mammary gland, uterus, and testicle. Hodgkin says that it is not uncommon in tendon; but this is probably a mistake, as the assertion is not sustained by other authority. The disease has never been observed, so far as I am aware, in the eye, brain, heart, lung, liver, kidney, thyroid gland, the voluntary muscles, the serous and fibrous membranes, the tonsils, œsophagus, vagina, penis, urinary bladder, in the nerves, cartilages, or blood-vessels. It sometimes affects several organs simultaneously, or in more or less rapid succession. It may coexist with scirrhus and encephaloid, but I do not know that it has ever been found associated with melanosis or hydatids.

The *period of life* most obnoxious to this disease is from thirty-five to fifty. Cruveilhier gives an instance of it in a patient of sixty-eight. It has been noticed several times in subjects under twenty years of age, and it is altogether probable that it may occur at a much earlier period. It has been observed in both sexes, but whether it is more frequent in one than the other, the present state of our knowledge does not enable us to determine. The disease may occur in quadrupeds. During my residence in Cincinnati, I met with two well-marked examples of it in the superior maxillary bone of the ox, the animals being otherwise perfectly healthy.

How this disease originates, or what the causes are under the influence of which it is developed, we are entirely ignorant. Its progress is usually slow, except when the tumor is very vascular, when it is apt to grow with great rapidity. It manifests no disposition to ulcerate, as is the case with scirrhus and encephaloid; is never the seat of hemorrhage or much pain; the general health usually holds out well; and the countenance rarely acquires that sallow, cadaverous hue so common in some of the other forms of carcinoma.

## PART II.

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# SPECIAL PATHOLOGICAL ANATOMY.

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## CHAPTER I.

### OF THE BLOOD.

Physical Properties. — Chemical Analysis. — Division into Serum, Fibrin, and Hematosine. — Lesions of the Blood. — Nature and Formation of the Buffy Coat. — Cupped appearance of the Blood. — Want of Coagulability. — Relative quantity of Fibrin in healthy and diseased Blood. — Alterations of the Hematosine. — Lesions of the Serum, in Inflammation, Dropsy, and other Maladies. — Changes of the Blood, from acceleration of the Circulation and Division of the Pneumo-gastric Nerves. — Appearances in Cholera, Fever, Chlorosis, and Scurvy.

THE blood, derived from the chyle and lymph, is a thick, opaque fluid, contained in the heart and arteries, the capillaries and veins, by which it is distributed, as by so many canals, to every part of the animal fabric. Examined as it flows from the arm, it is of a dark reddish color, slightly saline to the taste, somewhat viscid to the touch, of the average temperature of 96° of Fahrenheit's thermometer, and apparently homogeneous in its nature. On remaining at rest, however, for about three minutes and a half, it begins to concrete, and, finally, in about three minutes and a half more, separates into two parts, one of them, thin and watery, termed the serum of the blood, the other, red and solid, named the crassamentum, cruor, or clot. The process by which this disunion is effected is denominated coagulation, and generally requires from five to twenty hours for its completion.

Respecting the actual quantity of blood contained in the entire body, our means of appreciation are altogether too inaccurate to enable us ever to arrive at any satisfactory conclusions. Fixing the ordinary standard of the adult human body at one hundred and fifty pounds, it may be supposed that the average amount of blood is about eighteen pounds, of which eleven are contained in the veins, seven in the arteries. This estimate nearly coincides with that of Sir Astley Cooper, who, from an experiment performed on a small dog, was led to infer that the proportion of the blood, as compared with the solids, is as one to sixteen. Fortunately, it is not of much practical import-

ance whether our data on this point are correct or not, since in the abstraction of blood from the system, the interest tyro in the profession is governed, not by the amount or quantity, but by the effects it produces on the individual.

From the great discrepancy still existing among authors concerning the specific gravity of the blood, it may reasonably be presumed that it varies, not only in different persons, but even in the same individual, at different periods. Compared with water, its mean specific gravity is generally stated to be as 1052 to 1000 ; or, in other words, as about one-twentieth part heavier than that fluid. In ten observations, I found it range from 1002, the minimum, to 1031, the maximum. According to some, however, it has been found as high as 1126 ; but this, if true, must be regarded as an exception.

Various attempts have been made to ascertain the different constituents of the blood of the human subject. The latest and most complete analysis that we possess, is that published by Dr. Lecanu, a distinguished chemist of Paris. A careful examination of the blood of two robust, healthy men, afforded the following results : \*

Water	-	-	-	-	780·145	785·590
Fibrin	-	-	-	-	2·100	3·565
Albumen	-	-	-	-	65·090	69·415
Coloring matter	-	-	-	-	133·000	119·626
Fatty crystallizable substance	-	-	-	-	2·430	4·300
Oily matter	-	-	-	-	1·310	2·270
Extractive substances soluble in alcohol and in water	-	-	-	-	1·709	1·920
Albumen combined with soda	-	-	-	-	1·265	2·010
Chloruret of potassium and sodium, together with alkaline subcarbonates, phosphates, and alkaline sulphates	-	-	-	-	8·370	7·304
Subcarbonate of lime and magnesia, with the phosphates of these salts and of iron	-	-	-	-	2·100	1·414
Loss	-	-	-	-	2·400	2·586
Total	-	-	-	-	1000·000	1000·000

Since this analysis was made, Dr. Boudet,† another French chemist, has shown that the fatty crystallizable substance above mentioned is identical with cerebrine, discovered by Vauquelin in the brain, and that the oily matter is a mixture of cholesterine and an alkaline soap, similar to that which is met with in the bile.

From these results it follows, that the blood, instead of being a homogeneous fluid, as it would seem to be before it has undergone coagulation, consists of a great number of ingredients, existing in various proportions, and differing from each other essentially in their character. To these, chemistry, which has of late years been making such rapid progress, will no doubt add others, until the list will be swelled far beyond what it is at present.

So much respecting the nature and composition of the blood, considered as a mass. Let us now make a few remarks concerning its three grand constituents, — the serum, fibrin, and hematosine.

Serum, when pure, is of a yellowish straw color, slightly tinged with green, of a saltish taste, unctuous to the touch, and perceptibly alkaline. Its me-

\* Ann. de Chimie, 2<sup>e</sup> série, t. xxiii.

† Op. cit., t. lii.



dium specific gravity is about 1029, or a little greater than that of the cruor, though this is by no means constant, as the latter not unfrequently sinks in it. From the analysis of Berzelius, it would appear that one hundred parts of serum are composed of about ninety parts of water, eight of albumen, and the remainder of earthy salts. Besides these ingredients, Dr. Lecanu has recently detected in this fluid both an oily and a fatty matter, in the proportion of one part of each to one hundred of serum.

Serum is readily coagulated by heat; and the same result is produced, though less perfectly, by alcohol, a solution of corrosive sublimate, and the dilute mineral acids. On being cut into thin slices, and subjected to pressure, the hardened albumen yields a transparent watery fluid, holding in solution a little muriate of soda and about one-fiftieth part of its weight of animal matter, the precise nature of which is unknown. This fluid, it may now be observed, is technically called the *serosity*; and for the first account of it we are indebted to Dr. Butt, of Edinburgh, who described it in 1760.

Very recently, Boudet has detected another substance in the serum, to which he has given the name of *seroline*. It is a white, slightly opalescent matter, fusible at about 94° of Fahrenheit, insoluble in water, but soluble in alcohol, and containing, apparently, a minute quantity of azote. Thus serum would seem to be a very compound substance.

The crassamentum is a thick, opaque, spongy mass, of a dark reddish color, somewhat lighter, as a general rule, than the serum in which it floats. If it be washed for some time under a gentle stream of water, it may be separated into two portions, one of which is solid, and constitutes what is denominated the fibrin of the blood, while the other, dark and soft, essentially consists of hematosine: these two substances exist in varying proportions. The weight of the fibrin usually exceeds that of the serum, but is less than that of the hematosine. In twenty experiments by Lecanu, the medium amount of fibrin in one hundred parts of blood was four, from which it ranged from one, the minimum, to seven, the maximum.

Hematosine is invariably heavier than fibrin, on which account it generally subsides to the bottom of the crassamentum during the coagulating process. Its relative proportion to the other constituent principles varies remarkably in different individuals, so that no very accurate information has yet been obtained respecting it. Berzelius calculated that it formed about sixty-four parts of the cruor in the one hundred; but, according to the more recent researches of some of the French chemists, the amount is considerably less. This substance is intimately connected with the globules of the blood, and is always of a deeper hue in proportion to the health and vigor of the animal. The globules themselves are of a spherical figure, and about the 1-3500th of an inch in diameter.

Concerning the nature of hematosine, chemists are still at variance. According to the analysis of Michaelis, it appears to consist essentially of the same ingredients as fibrin and albumen, with the addition of a small amount of iron, which the other elements want. Berzelius was the first, I believe, to announce this substance, the existence of which was questioned until about twenty years ago, when it was fully established by Dr. Engelhart, of Germany. From the fact that iron resides exclusively in the hematosine, it was natural to suppose that it imparted to that matter its peculiar color, — an idea, which, as has been suggested by the late Dr. Turner, of London, receives additional support from the well-known tendency of the peroxide of that metal to form red salts. It is, nevertheless, highly probable that its presence is merely accidental, and that the coloring substance is a peculiar animal principle, capable, like madder,

of acting as a dye, and of combining with metallic oxides, the most effectual of which are those of tin and mercury.

Such is a rapid sketch of the appearances which this fluid presents in the healthy state. Let us now turn our attention to some of the principal alterations which it undergoes in disease.

Although I do not feel disposed to attach that great importance to the blood which the advocates of the old humoral pathology did, yet it cannot be denied that it is decidedly the most essential fluid in the animal economy, inasmuch as it furnishes the various materials which dispense vitality and nourishment to the different tissues, as well as vigor to its several organs, serving thus, in the expressive language of our medical ancestors, as the *pabulum* of life. From it all the solids are formed, and all the other liquids secreted; and hence it may justly be considered as the basis of every part of the complicated fabric, as, without it, it would be utterly impossible for any growth, whether healthy or morbid, to take place. Pervading every portion of the body, and penetrating every fibre, however minute, or however constituted, — acquiring constantly new properties as it passes through the lungs, and losing them again as it meanders through the rest of the system, — it is in the highest degree probable, that, whilst it thus fertilizes the various structures, it may convey to them alike the elements of general health and of general disease. So long as it preserves its integrity, the impression which it makes upon the solids must be of the most salutary kind, calculated to stimulate the whole machine, and rouse it to the proper performance of its functions. Any departure from this state, although so slight as to escape our notice, would be followed, it is reasonable to presume, by a corresponding derangement in the hard parts. In inflammatory affections, it undergoes most important changes, exhibiting frequently, as will be presently seen, a peculiar buff-colored aspect: in dropsy, it is thin and pale, like weak claret; in plethora, on the contrary, it is thick, remarkably tenacious, firm, and of a deep red complexion. If it be imperfectly elaborated, a morbid diathesis is established, which often lays the foundation of mortal maladies, and which is transmitted, in many instances, from the parent to the offspring. In this way “God visits the iniquity of the fathers on their children, down to the third and fourth generation,” as is exemplified in the hereditary predisposition to arthritic and tubercular diseases, mental imbecility, and a host of other disorders, as afflicting to the patient as they are generally perplexing to the practitioner.

In the further discussion of this subject, I shall describe, in the first place, the lesions of each of the three grand constituents of the blood; and, secondly, its alterations in reference to the entire mass.

The most remarkable change which the fibrin of the blood experiences, and one which we have more frequent opportunities of observing in this country than any other, is that inflammatory condition which gives rise to what has been termed the *buffy coat*, or, from its frequent occurrence in acute disease of the serous lining of the thoracic cavity, the *pleuritic crust*. In general, it presents itself in the form of a thin lamella, of a pale straw color, which is spread over and closely adherent to the upper surface of the crassamentum, looking a good deal like a sheet of tallow. In some instances, it is of the color of a lemon-rind, nearly white, or greenish. The latter appearance is especially conspicuous in the blood of pregnant females, and has been considered by some, though erroneously, to be an indication of that particular state.

The formation of the buffy coat is always consentaneous with the process of coagulation, appearing at first like an opaque, viscid film, of a reddish opaline tint, and of a consistence equal to that of mucus, which is either diffused over

the whole surface of the fluid, or occurs in small insulated spots, looking like so many little islands in the midst of a body of water. Whilst warm, this substance is remarkably tenacious, and may be drawn out in the form of little filaments, which, on cooling, assume a white or reddish aspect. When fully formed, which, however, it is not under some hours, the buffy coat is dense, elastic, slightly diaphanous, strongly adherent to the cruor, which it covers, smooth on its free surface, and rough on the other. Now and then it is remarkably soft, and reticulated, or like the interior of a honeycomb, from the development and rupture of little air-vesicles.

If the buffy coat be carefully separated from the crassamentum, washed in cold water, and then immersed in strong alcohol, its elastic properties will be greatly augmented, and the membrane will present the appearance precisely of a half-tanned hide, or of the proper uterine tissue during pregnancy. In this way I have prepared several beautiful specimens, which have now been in my museum of pathological anatomy for several years.

Various accounts have been published respecting the *chemical* constitution of the buffy coat, but it is to the researches of Dowler and Gendrin that we are indebted for the most precise information. From the observations of these physicians, it clearly appears that this substance is essentially composed of fibrin, containing a considerable but variable amount of albumen and serum, or what Dr. Babington has termed the *sanguineous liquor*, which may be squeezed out by pressure. The greatest analogy thus exists, both as regards appearance and chemical composition, between the buffy coat of the blood, as exhibited in certain diseased states of the system, and the substance that constitutes the adventitious membranes of the serous cavities.

Considerable diversity prevails in respect to the *thickness* of the buffy coat, this depending on the intensity of the disease, and the nature of the affected part. Most commonly it does not exceed the eighth of an inch; but, in some rare instances, I have known it to be from three to six lines. As a general rule, it may be stated to be greater in plethoric subjects than in such as are weak, and in inflammations of the joints, serous membranes, and parenchymatous organs, than in similar diseases occurring in other structures.

The consistence of the buffy coat is also liable to vary. In typhus, scurvy, and chlorosis, — in short, in all cachectic states of the body, it is generally soft and brittle, thin, iridescent, and of a dirty yellowish color. On the contrary, in simple inflammatory affections, it is usually highly tenacious, thick, and of a uniform opaline tint.

This peculiar appearance of the blood, it may now be observed, occurs in all inflammatory disorders, and, in fact, in almost every condition of the system in which there is a predominance of vascular action. It is usually found in the acute stages of pneumonitis, hepatitis, scarlet-fever, small-pox, gout, rheumatism, and invariably, perhaps, in pleurisy; at least, I do not remember ever having bled a patient laboring under this affection in whom the blood was not more or less buffed. It is also very generally met with in pregnant women, in dropsy, in chronic diseases of the chest and abdomen, in scurvy, in chronic gout and rheumatism, and in those who resort to frequent venesection. In chronic inflammation, in whatever tissue or organ seated, the buffy coat usually continues for a long time, especially if it be attended with much constitutional disturbance, reappearing at almost every repetition of the bleeding until the malady wholly subsides. The same phenomenon is witnessed in those affections in which the primary morbid impression seems to be made on the circulating current, as small-pox, for example, the virus of which is evidently absorbed by the vascular system. At the commencement of this disease, the blood is usually covered with a tolerably thick crust, but this crust seldom



exists, or, at most, only in a very slight degree, prior to the establishment of the eruptive fever. When the exanthem is moderate, the quantity of buffy matter is commonly very small: in nearly all cases it continues until the scabs are perfectly dried, and occasionally even a few days later. Baglivi, one of the most celebrated physicians of the seventeenth century, has justly remarked that the presence of a thick inflammatory crust, at the beginning of small-pox, is a sure indication of a plentiful crop of pustules, — a fact which has been amply verified by more recent observation.

The relative frequency of the buffy coat in various diseases is exhibited in the following table, compiled from Andral:

Diseases.	No. of Cases.	Perfect buffy coat.	Imperfect buffy coat.	Absence of buffy coat.
Acute amygdalitis . . .	12	9	1	2
Bronchitis . . . . .	132	35	25	63
Lead colic . . . . .	10	3	—	7
Chlorosis . . . . .	11	7	1	3
Cerebral congestion . .	103	14	12	77
Pleuritic effusion, recent and chronic . . . . .	27	7	9	11
Intermittent fever . . .	32	5	—	27
Typhoid fever . . . . .	187	10	30	147
Cerebral hemorrhage . .	22	2	—	20
Hypertrophy of the heart	72	11	—	61
Albuminuria . . . . .	6	—	—	6
Pneumonitis . . . . .	230	215	15	—
Acute rheumatism . . .	134	125	5	4
Chronic rheumatism . .	50	11	—	39
Measles . . . . .	11	—	—	11
Scarlatina . . . . .	9	—	—	9
Pulmonary tubercles . .	203	140	13	50

Persons sometimes labor under intense inflammation, and yet the blood does not exhibit the buffed appearance until after they have been bled several times. The reason of this is not very obvious; but we may suppose that the system in these cases is so surcharged with blood, or that the heart and vessels are so exhausted that the usual nervous energy upon which the slow coagulation of this fluid depends is not imparted. At other times, the reverse of this obtains, — the blood which flows first exhibiting the buffy coat, whilst that which is drawn towards the close of the operation will have little or none of it. This phenomenon is particularly apt to take place when the blood is allowed to issue slowly from a small orifice.

The manner in which the formation of the buffy coat may be modified by the state of the nervous system, is well illustrated by a case related by Hewson.\* A young, robust man was bled during an attack of inflammatory fever. On opening the vein, the blood merely trickled down the arm, owing, apparently, to the fright of the patient; but, in a few seconds, it began to run quite freely. Three ounces were then received into a second cup, and a like quantity was immediately caught in a third. The individual now became faint, and was laid on

\* On the Blood, vol. i., p. 82, et seq.

the floor, when a few drachms more blood were taken in a fourth cup. Of these four measures of fluid, that which was removed last coagulated in three minutes, the first in twelve minutes, and the second in about twenty-two minutes. Neither of these had any inflammatory buff; but the blood received into the third cup began, in five minutes, to appear transparent on the surface; and, although it did not fully coagulate for upwards of half an hour, it had a remarkably thick, tough crust.

The immediate cause of this appearance is sufficiently obvious: the globules, with their colouring matter, begin to subside before the coagulation is completed, and thus the upper surface of the crassamentum is left without them. With regard to the remote cause, it can scarcely be said to be fully ascertained, notwithstanding the numerous attempts that have been made to discover it. Hewson thought that the fibrin was rendered specifically lighter than the red globules, by which the latter would be disposed to sink to the lower part of the cruor; he also supposed — which, however, is not true — that the blood always coagulated more slowly. Dr. Dowler, an English physician, who published an account of his theory in 1822, endeavored to explain the phenomenon on the assumption that inflamed blood contains an unusually large proportion of serum, which, by diminishing its viscosity, readily allows of the subsidence of the hematosine. Neither of these opinions, it seems to me, affords a satisfactory solution of the difficulty.

That the red particles are specifically heavier than the fibrin, is a circumstance with which every one is familiar; but as this is the case even in the sound state, very little use can be made of it as a proof of the position assumed by Hewson. Nor is it, as I before intimated, a fact that inflamed blood retains its fluidity a much longer time than healthy, as is asserted by the same ingenious author. In the great majority of instances, indeed, the very reverse of this obtains, — the concretion taking place with extraordinary rapidity. If this be true — and multiplied observations induce me to think it is — it is obvious that another explanation must be sought for. Shall we adopt the idea of Dowler, — that the phenomenon depends upon a redundancy of thin serum? This also is inadequate, for the fact, if it be one, remains to be established. The explanation which I would propose is this: in the healthy state, the fibrin is exceedingly tenacious, and the red particles are so intimately connected with it, as to render it impossible for them to subside during the coagulation, however slowly this may be effected. In inflammatory affections, on the contrary, this cohesive property is either greatly diminished, or, what is more probable, the fibrin loses its affinity for these little bodies, which consequently gravitate to a greater or less depth before the blood separates into its two grand constituents. In this manner the top of the crassamentum is covered with a buff-colored layer, the thickness and density of which vary according to the repulsive power existing between the two elementary principles referred to, the intensity of the disease, the general state of the system, and the extent of the contraction of the inspissated mass. The reason why this separation is not effected whilst the blood is circulating within its vessels, is the constant motion to which it is subjected, which is incompatible with the process. How far the explanation here offered is correct, I cannot pretend to determine: I throw it out merely as a hint, in the hope that others may be induced to test its truth, or point out its fallacy.

Every physician knows how much the formation of the buffy coat is influenced by extraneous circumstances. Of these, the most important are the shape and capacity of the receiving vessel, the degree of motion to which the blood is subjected, and the size of the orifice in the vein. Dr. Belhomme, of

Paris, who has minutely investigated this subject, in a series of one hundred and fifty experiments, has come to the conclusion, that a narrow basin, a large orifice, and a full, rapid stream, in the form of an arch, are the external circumstances most favorable for producing the buffy coat. The results of these researches have since been verified by those of Gendrin\* and other physiologists; and they are well worthy of being remembered on account of their practical bearing.

If blood be drawn simultaneously from both arms, it will generally be perfectly uniform, both as respects the quantity of the serum and the density of the cruor. Should the blood, however, run disproportionably slow on one side, there will be no appearance of inflammatory crust, whilst it will readily form on the blood which issues from the other, for the obvious reason, that in the former case the liquid will concrete before the red globules have time to disengage themselves from the fibrin; whereas, in the latter, the fluidity will be sufficiently protracted to admit of this occurrence. This circumstance is alluded to by Rush, in his "Defence of Blood-letting," published soon after the beginning of the present century. In a case of pleuritis, the blood which was taken from one arm, he observes, was sizzly, whilst that which flowed from the other was of a scarlet hue; similar appearances were noticed by him in the blood of a pregnant female.

It will be seen, from the foregoing remarks, that we cannot, as a general rule, consider the inflammatory crust as depending uniformly upon the shape of the receiver, the size of the orifice, or the volume of the stream, since all these circumstances merely modify, but can never produce the buffy coat, unless the fluid is susceptible of it, or has undergone those changes which are necessary for its development. Nevertheless, it should be borne in mind, when we wish to draw any legitimate conclusions in relation to the inflammatory crust, that it is all-important that the blood should not be exposed to too low a temperature, that the receiver should be rather narrow and deep, and, lastly, that the orifice in the vein should be large enough to furnish at least two ounces of fluid in a minute. To effect this, the incision should be about a line and a half in length, and the blood should run in a full, continuous jet.

When the middle of the buffy coat is depressed, or scooped out, as it were, it is said to be *cupped* (Fig. 47). This appearance is generally limited to the upper

Fig. 47.



surface of the crassamentum; but I have occasionally witnessed it also upon the lower surface, though never to the same extent. This appearance is very common in nearly all diseases of a highly inflammatory character, such as pleurisy, peritonitis, rheumatism, and gout. Venous blood is not alone susceptible of being buffed and cupped: the same phenomena are observed in arterial blood, and the only reason, perhaps, why they are not so familiar to us, is owing to the less frequent performance of arteriotomy than of venesection. The manner in which this cupped condition of the blood disappears, is well exemplified in a case which a few years ago came under the notice of my friend, Dr. Charles Woodward, of Cincinnati. He attended a

\* Histoire Anatomique des Inflammations, t. ii.



married lady under a violent attack of pleuritis, for which she was several times bled; the blood which was taken on the first day of the treatment was deeply buffed and cupped. Twenty-four hours after the same appearances were exhibited, except that the clot was not quite so much depressed in the centre; in twelve hours more, the fluid was still buffed, but no longer cupped; and, at the fourth operation, performed three days after the first, it was neither buffed nor cupped.

This cupped state of the blood, as just hinted, is generally indicative of the highest degree of inflammatory action, yet, strange as it may seem, it is not unfrequently found in very opposite conditions of the system, as in persons who are greatly exhausted by hemorrhagic and other profuse discharges, and who do not evince the slightest symptoms of phlegmasial excitement. Most commonly, it occurs in connection with inflammation of the serous membranes and the parenchymatous organs; being seldom present in that of the mucous and dermoid textures.

Although it is not consistent with the plan of this work to enter upon any therapeutic considerations, yet I cannot dismiss this branch of our subject without briefly inquiring how far the buffy coat should be regarded as an index to the abstraction of blood. We have already seen that this phenomenon occurs under very opposite states of the system, in the most debilitated as well as in the most robust, in the highest degrees of disease as well as in the lowest, and in individuals who are in the enjoyment, apparently, of the most perfect health. The blood, in the advanced stages of pregnancy, is almost always covered with a layer of fibrin; and the same thing is generally observed in persons that have suffered from profuse hemorrhages of the stomach, lungs, or other organs. In individuals subjected to a course of mercury, the blood drawn from the arm is frequently as much buffed as in the most violent attacks of gout or pleurisy, notwithstanding the great reduction of the vital powers. The same effect may be produced simply by taking severe exercise. Thus, if a horse be bled immediately after a smart gallop, while the circulation is carried on with great vigor, the blood will exhibit the buffy coat, whereas that previously abstracted will be perfectly free from it.\* Similar appearances have been repeatedly witnessed in the human subject. If these circumstances be coupled with the fact, that the buffy coat may be entirely absent, even in the most intense inflammation, the conclusion is obvious, that the phenomenon in question can neither be regarded as a certain test of morbid action either in the solids or in the vital fluid, nor a safe index of the propriety of blood-letting.

The fibrin is sometimes remarkably destitute of coagulating power. This is strikingly evinced in persons who are suddenly destroyed by lightning and electricity; a violent blow on the stomach, or severe injury of the brain; by the bite of venomous serpents; by acid vegetable poisons, such as prussic acid; excessive bodily fatigue; and even violent agitation of the mind. It is also frequently witnessed in Asiatic cholera, in scurvy, and in malignant fevers. Occasionally, too, it is present, and yet the individual is apparently in the enjoyment of good health. Under such circumstances, the most trifling injury may prove fatal, since the only means by which hemorrhage can be successfully combated is taken away, the blood refusing, in spite of all our efforts, to coagulate. Mr. Wardrop, of England, in a short but valuable treatise on blood-letting, published a few years ago, has cited a number of cases of this kind, several of which came under his own immediate observation. In

\* Babington, *Cyclopedia of Anatomy and Physiology*, Part v., p. 420.

one of the instances alluded to, the patient died from hemorrhage, induced by the introduction of a seton in the side ; in another, from a slight wound of one of the fingers ; in a third, from the extraction of a tooth ; in the fourth, from a superficial wound in the palm of the hand ; and, in the fifth, from a bite of the tongue.

A few years ago I lost a male infant, five months and a half old, from hemorrhage caused by the division of the gum over the central incisors of the upper jaw ; the bleeding came on in less than twenty-four hours after the operation, and, resisting all the means which I could employ for its suppression, proved fatal at the end of the fifth day. A few days before death hemorrhagic spots appeared in various parts of the body. The child had been born of healthy parents. During my residence in Cincinnati, a case of fatal bleeding occurred from the extraction of a tooth. The patient was a servant girl, fifteen years old, of delicate constitution, who had never menstruated, and had been in bad health for about four months previously to her death. During the last six weeks she had been taking a variety of the most powerful emenagogues, without any apparent benefit. In this state, Dr. Barnes was requested to extract the second molar tooth on each side of the lower jaw. Five days after the operation, the patient was attacked with profuse hemorrhage from the wounded sockets and surrounding structures, which persisted, notwithstanding the employment of the most energetic measures, until in a short time she died perfectly exhausted. In compressing the parts with a piece of cork, the bleeding could be temporarily arrested, but the blood would soon ooze out from the mucous membrane of the cheek.

Dr. J. A. Swett,\* of New York, has recorded a case in which this tendency existed in all the children, eighteen in number, of the same family. All but one had died from this cause, and he was suffering under profuse hemorrhage of the nose and rectum. Twelve sisters died before the age of twelve from bleeding of the uterus ; two of the brothers had fallen victims to traumatic hemorrhage.

Mr. Wardrop gives a curious case in which this peculiarity was hereditary. The patient was a boy, and the hemorrhagic tendency displayed itself when he was scarcely two months old. On several occasions, he nearly lost his life from the most insignificant wounds. His brother, twenty-two years old, was frequently afflicted in the same way. Of his five uncles, not one was free from this predisposition : three died after a division of the frænum of the tongue, one from the extraction of a tooth, and the other, although he suffered from the same disease, finally died from some other cause. His two aunts exhibited no signs of this diathesis ; but, what is singular, all the male branches of their families, excepting one, were thus affected.

A still more remarkable case has been recently reported by Dr. Hughes, of Kentucky. The predisposition here was associated with a rheumatic diathesis, and was satisfactorily traced as far back as five generations. It was confined exclusively to the male branches of the different families ; but the females, nevertheless, invariably transmitted it to their offspring. Many of the individuals died in infancy and childhood, — death resulting in some from the cut of the lancet ; in some from accidental wounds ; in some from internal hemorrhage ; and in two simply from the application of blisters, the vesicles being filled with blood instead of water.†

To what is this want of coagulating property of the blood to be ascribed ?

\* New York Jour. Med. & Surg., July, 1840, p. 174.

† Transylvania Journal of Medicine, vol. v. For a similar case, related by the same gentleman, see Op. cit., vol. iv., p. 518.

That it is owing, at least in part, to an insufficient supply of nervous influence, upon the presence of which the vitality of the fluid in question essentially depends, cannot, I think, be denied. The matter indeed, may be considered as reducible to a syllogism that contains its own proof. The direct influence of the nervous system on the blood was long ago contended for by Barthez and other physiologists, and has been happily elucidated, in our own time, by the researches of Dupuytren, Brodie, Thackrah, Dupuy, and others. These experimentalists ascertained, that, whenever the pneumo-gastric nerves are tied in animals, the blood lost its property of coagulating, the coloring matter at the same time separating from the fibrin. Mayer, on the other hand, in repeating the operation, always found the blood uniformly clotted throughout the whole pulmonary circle. Sir Astley Cooper in his researches observed that the sanguineous fluid was of a semi-concrete consistence, and of a dark modena color, even in the arteries; the lungs were so much loaded with it as to be twice as heavy as in the normal state. Simple division of these cords does not appear to give rise to these effects, probably for the reason that it does not produce any serious obstacles to the transmission of the nervous current.

The influence of the nervous system, however, is no where more strikingly evinced than in the effects produced by a severe blow on the cœliac ganglion. Here death is caused with the same rapidity as by lightning and the most subtle poisons; and the blood, as was before stated, exhibits precisely similar appearances, being unusually black, dissolved, and incapable of separating into serum and crassamentum.

I shall only further illustrate this interesting branch of our inquiry, by a passing notice of the relative quantity of fibrin contained in healthy and diseased blood. Upon this subject, the late Mr. Thackrah, of England, made numerous experiments, from which he deduced the conclusion that there is always a great redundancy of this substance in inflammatory disorders, even when there is an entire absence of the buffy coat. Sir Charles Scudamore has more recently confirmed these facts, and Mr. Jennings has verified his results,\* so that the question must be considered as finally settled. The increase, in most of the experiments performed by these physicians, was about two-thirds above the normal standard; and it would appear that it is proportionably greater in gouty and rheumatic affections than in any other maladies.

Andral† and Gavarret have shown that in all acute inflammations a peculiar condition of the system is engendered, in consequence of which the blood is suddenly surcharged with fibrin. It does not matter what may have been the previous health, the supervention of an attack of this kind involves necessarily, in every case, an increase of this substance above the natural standard. This law obtains in animals, as the dog, horse, cow, and sheep, as well as in man. In the human subject, when the inflammation is fully established, the fibrin varies in quantity between 6 and 8; in some cases it rises as high as between 8 and 9; and occasionally, though rarely, it reaches 10½. The elevation dates from the very commencement of the morbid action, and may therefore be regarded as the pathognomonic sign of it. The only exception to this, so far as at present ascertained, is in utero-gestation, in which, both in the

\* Transactions of the Provincial Medical Association for 1834.

† Andral considers the average proportion of fibrin in healthy blood as 3 to 1000. It may be found, however, as low as 2·5 or 2, and as high as 3·5 or even 4. The mean proportion of the globules he fixes at 127 parts in 1000; the extremes in the physiological condition of the system being 140 and 110. The solid materials of the serum are estimated at 80 parts in the 1000, and of these from 68 to 70 are pure albumen. The water of the blood is fixed at 790. See *Pathological Hematology*, translated by Drs. Meigs and Stillé, p. 30, Philada., 1844; also *Recherches sur les Modifications du Sang dans les Maladies*, par Andral et Gavarret, *Annales de Chim. et de Phys.*, t. lxxv., Nov. 1840.



human subject and in the inferior animals, the blood, especially as the period of confinement approaches, always contains a redundancy of this substance, and displays a remarkable tendency to assume the character of inflammatory blood.

It has been supposed that the tying of the pneumo-gastric nerves in the neck has the effect of diminishing the quantity of fibrin in a very notable manner. Dupuy having performed this operation, drew a certain amount of blood from the carotid artery, and ascertained that it contained twenty-one grains of fibrin. In a few hours after, the same amount contained only nineteen grains; at the end of sixteen hours, eighteen grains; and, at the end of forty hours, twelve grains. In a little more than two days from the operation, the horse died in a state of asphyxia, when the same quantity of fluid, still taken from the carotid, had only seven grains of fibrin.\* The question naturally presents itself, — was the progressive diminution, here spoken of, directly produced by the division of the pneumo-gastric nerves, or indirectly by disturbing the process of sanguification? In all probability the section of the nerve had nothing to do with it; for it is not at all unlikely, though this is not stated, that the animal at each bleeding lost more blood than was necessary for the purposes of the experiment; and, if this be admitted, the facts observed by Dupuy, though he accounted for them in a very different way, will be found to tally with the results of the experiments of Dr. Andrews, alluded to in another part of this chapter.

The *hematosine*, the second constituent of the crassamentum, is no doubt often altered in disease; but what these changes are, or with what states of the fluids or solids they are connected, has not yet been determined. In many maladies, it seems to disentangle itself from the globules in which it naturally resides, and to percolate through the vessels into the different cavities of the body, or into the interstices of some of the organs. This disengagement frequently occurs in sea-scurvy, in malignant dysentery, and in typhus fever, and is the cause, in all likelihood, of the passive hemorrhage and petechial spots which are so commonly met with in these affections. To the same circumstance is to be attributed the stained condition of the endocardium and the inner membrane of the vessels, which usually takes place within a short time after death, especially in warm weather, and which has sometimes been mistaken for the effects of inflammation.

The hematosine often exists very sparingly. This diminution, as might be anticipated from its apparent cause, is usually connected with those conditions of the system which are characterized by great debility, whether occasioned by impoverished living, protracted indisposition, or profuse hemorrhagic discharges. It is very constantly met with in chlorosis, in ascites, in organic affections of the stomach, and duodenum, in persons who are frequently bled, and in females who suffer habitually from menorrhagia. As having a direct bearing on this subject, it may be stated that women have always, comparatively speaking, less hematosine in their blood than men, — a fact which was first ascertained, I believe, by Lecanu, and which, he thinks, is attributable to their monthly evacuations. The following comparative view is the mean of his analysis made with blood drawn from ten adults of both sexes: —

					Female.	Male.
Water -	-	-	-	-	804·37	789·32
Albumen	-	-	-	-	69·72	67·50
Saline and extractive matter	-	-	-	-	9·95	10·69
Red globules	-	-	-	-	115·96	132·49
					1000·00	1000·00

\* Andral, Anat. Path., t. i., p. 204.

In the above diseases, the countenance is remarkably blanched from the want of hematosine, the different tissues are literally exsanguineous, the nutritive function is badly executed, and there is great failure of the strength, with a disposition, in many cases, to cellular infiltration of the extremities. This state of things often persists for months, and occasionally, as in chlorosis, even for years, — a fact strongly illustrative of the tardy reproduction of the hematosine on which it depends. The blood, under such circumstances, is absolutely impoverished, being scarcely fit for the purposes which nature has assigned to it, from the absence of fibrin and red particles. Acute maladies produce, in effect, the same results, with this difference, that these two important elements of the vital fluid are usually much more quickly regenerated, especially when the individual has the benefit of free exercise and animal food.

There are some maladies, such as cholera, typhus, and plague, in which the hematosine is unusually black. The reason of this has not yet been determined. By some it has been attributed to a diseased state of the blood, by which it is rendered unfit for being duly arterialized by exposure to the atmosphere. Such, amongst others, is the opinion of Dr. Thomson, of Europe, which, however, is directly at variance with that of Dr. O'Shaughnessy, who maintains, and I believe correctly, that cholera blood is not only capable of absorbing oxygen, but also that it emits carbonic acid gas. Dr. Stevens, on the other hand, supposes that the black color is directly ascribable to the contaminating influence of the contagious virus of this disease, whereby the circulating fluids are changed in their character, at the same time that they suffer a great loss of saline matter. These views are, neither of them, it seems to me, entitled to much respect, as not one of them, with the exception, perhaps, of the latter, is supported by positive facts. In the production of the appearance under consideration, we may suppose that the combined agency of several causes is necessary. Amongst these, the most important, without doubt, is the partial abstraction of the vital properties of the blood, producing thereby a general impairment of the various functions of the system. In no organ is this disordered action carried to so great a degree as in the lungs, where, although the atmosphere still comes in contact with the delicate air-cells, the sanguineous fluid, from its exhausted condition and destitution of saline principles, is no longer susceptible of being properly arterialized. That this is true, is abundantly established by pathological anatomy, physiological experiments, and chemical analysis; for, as will be seen hereafter, the blood, in the diseases referred to, is generally extremely black, dissolved, highly carbonized, and sometimes almost entirely drained of its salts. In cholera especially, these states of the blood are amongst the most uniform occurrences; and it is to them that are to be mainly attributed the livid color of the skin, the embarrassed breathing, and the rapid exhaustion which those who are the subjects of the malady generally exhibit.

To this general statement several other facts, strongly corroborative of what we have said, may now be added. In the first place, we may notice the effects that result from a division of the pneumo-gastric nerves, which are the governors, if I may use the expression, of the respiratory organs. This experiment is invariably followed by a suspension of the arterializing process, in consequence of which the blood, both in the veins and in the arteries, is always found of a black colour after death. The same effect has been observed by Sir Astley Cooper to be produced by merely tying these nerves. The blood, he states, also flows of a dark color when the carotid artery is opened after the phrenic nerves have been secured: the lungs, however, in

this case, are not found heavy and engorged, as in the former. These researches, together with many others of a similar character that might be cited, clearly demonstrate the dependency of the arterializing process upon the nervous influence. Take this agent away, and the vital fluid becomes darker and darker, until at length the lungs are rendered utterly incompetent to make any salutary impression upon it.

These changes, secondly, are generally produced more rapidly in proportion to the abstraction of the salts of the blood. The truth of this remark is strikingly corroborated by what occurs when we inject saline fluids into the veins of cholera patients,—an operation which was performed successfully in several instances, both in this country and in Europe, during the prevalence of this disease. In the collapsed stage of this disease, when the individual is actually in a state of asphyxia, the skin cold and livid, the respiration labored, and the pulse imperceptible at the wrist, no sooner are the watery and saline materials restored, than the whole aspect of things is changed; the heart begins to act with increased vigor, warmth is diffused throughout the body, the breathing becomes easier, the strength returns, and the surface recovers its accustomed hue. Blood drawn from the arm, under these circumstances, will exhibit, if not its usual appearance, a very close approximation to it. Thus, then, there are at least two elements concerned in the production of the black color of the hematosine, — a partial abstraction of the vital principle, and a diminished amount of saline matter. Whether these are the only ones, I cannot pretend to decide; nor can we expect to be able to remove the veil which still enshrouds the subject, until animal chemistry shall make further discoveries, and reveal to us the true nature of hematosine, its mode of origin, and the manner in which it is combined with the other principles of the blood. Until this be effected, no speculation on the part of the morbid anatomist, however refined or ingenious, can be entitled to any sort of confidence, or throw any real and substantial light upon the question at issue.

The *serum*, like the *cruor* with which it is so intimately combined, is liable to various alterations, carried to such a degree, frequently, as to entitle them to be termed morbid. Thus it has been found to have the aspect and consistence of milk; to have streaks upon its surface like cream; to have oil in it; and, finally, to be remarkably destitute of saline and animal principles. These changes may occur exclusively in the serum; but there is reason to believe that, in the great majority of instances, the fibrin and hematosine participate in them.

The occurrence of *milky serum* is not so uncommon, I am disposed to think, as the silence of the profession in regard to it would lead us to infer. Morgagni relates two cases of malignant fever, in which he noticed this appearance: Mr. Hewson also mentions several examples of it; and, since his time, numerous instances have been recorded by other writers. This state of the serum is usually met with in inflammatory disorders, and seems to be connected, in some way or other, with deficient assimilating power of the digestive organs. In a case of milky serum, which fell under my observation in 1832, the patient, a young man, thirty years of age, had long been addicted to the intemperate use of ardent spirits, and at the time here specified he laboured under symptoms of pleuritis, accompanied with headache, want of appetite, and considerable constitutional disturbance. The blood, as it issued from the vein in the arm, had a singularly dirty, turbid appearance, not unlike a mixture of chocolate and milk. It had scarcely been drawn ten minutes before it began to assume a white creamy aspect; and it finally



formed a layer on the surface of the clot about the eighth of an inch in thickness. In the course of an hour some of this fluid was skimmed off and put in another vessel, in which it was allowed to remain during a period of half a day. On examining it, at the expiration of this time, I found it to be slightly concrete, of the specific gravity of 1.026, remarkably unctuous, and of a strong saline taste. It readily coagulated, on the addition of alcohol, corrosive sublimate, and the mineral acids, as well as on exposure to heat; and, on being viewed with the microscope, exhibited no appearance whatever of globules, — circumstances which justify the conclusion that it was essentially composed of albumen. The cruor in this case was somewhat more abundant than usual, and the quantity of serum of course less. It is worthy of remark, that, upon a repetition of the bleeding, twenty-four hours afterwards, the blood presented precisely the same characters as before.

Milky serum, as might be expected, always contains an inordinate amount of fatty matter. In a specimen examined by Laennec, 1000 parts were found to consist of 794 of water; 65 of albumen; 108 of fatty matter, cholesterine, and acid soap; 17 of elaine, margarine, and stearine; and 25 of saline and extractive substances. The fibrin and hematosine had nearly entirely disappeared; and, in place of the globules, there was a large quantity of fatty matter, which was suspended in the serum, and gave the fluid its characteristic milky aspect. Similar results have been obtained by Christison, Babington, Bertazzi, and other writers.

To the same class of cases ought to be referred, I apprehend, those in which the serum is said to have contained *oil*, of which several well-marked examples have been recorded by Dr. Traill, of Liverpool, in the twenty-fourth volume of the Edinburgh Medical and Surgical Journal. In the last specimen which he has described, the serum was of a light straw color, cream-like in its consistence, and at first apparently homogeneous. On being kept, however, for a short time, it coagulated, and was poured with difficulty from the bottle in which it was contained. On analysis, it yielded a large proportion of albumen and oil, the latter of which was so pure as almost to burn when exposed to the flame of a lamp.

It has been made a matter of inquiry to ascertain, if possible, the cause of this milky state of the serum. On this subject, however, there is no positive testimony. By some it has been attributed to the admixture of fatty matter; by others, among whom may be mentioned Haller, to the presence of crude chyle. That it is connected with deficient assimilating power appears altogether probable, both from the nature of the diseases in which this peculiar state of the serum is found, and from the resemblance which this substance bears to the fluid just referred to. Chyle, it is well known, varies in appearance as the food has or has not contained fatty matter: in the former case, its color is milk-white; in the latter, it is nearly transparent. Soon after being drawn, it coagulates, and subsequently separates into three parts, — one solid, which rests at the bottom of the vessel, and looks like fibrin; another liquid, which is analogous to serum; and a third, which forms a thin layer on the surface of the others, and is of an oily nature. If to this remarkable similarity between these two fluids we add the fact, that nearly all the cases in which milky serum has been observed were characterized by derangement of the chylipoietic viscera, it renders it more than probable, I think, that the appearance under consideration is owing to deficient assimilation, by which a larger amount of fatty substance is retained in the circulation than in the normal state. Where the fault actually resides, whether in the mesenteric glands, in the thoracic duct, or in the lungs, or in all these

organs, is a question which, in the present state of the science, it is impossible to determine. Future observations, cautiously and patiently conducted, will alone be adequate to solve the problem.

It is seldom that we find this state of the blood associated with the buffy coat. I know of but one case of the kind, which is reported in a late number of the *London Medico-Chirurgical Review*.<sup>\*</sup> It occurred in an intemperate man, forty-seven years old, who was bled for pneumonitis, attended with high febrile excitement; the crassamentum was coated with a thick layer of fibrin, and the serum exhibited not only a milky aspect, but likewise a milky odor. The urine, too, had a similar appearance, and was sparingly secreted.

It has been long a matter of observation, that, in high degrees of inflammations, the watery part of the blood is more viscid and of a deeper yellowish color than usual, presenting frequently the aspect and consistence of synovial liquor. This appearance is less evident when the clot does not float in, or occupy the centre of, the fluid. Gendrin has shown that the serum in these disordered conditions of the system contains at least twice as much albumen as in the healthy state, — a circumstance which readily accounts for its remarkable viscosity, its astonishing coagulable properties, its increased specific gravity, and its deep yellowish color.

In dropsical and cachectic persons, on the contrary, the serum is generally much thinner, and of a paler hue, than in such as are favored with an opposite state of the system. Its specific gravity is also much less, and there is a sensible diminution of albumen. Similar alterations take place in persons who are in the habit of being frequently bled. The effects thus produced, though long known, have been placed in a very striking light by the recent researches of Dr. Andrews, of England.<sup>†</sup> The animal selected for the experiments was the calf, which was bled from a large orifice in the jugular vein till symptoms of syncope were induced. The operation was repeated at intervals of twenty-four hours, during which the calf was generally once fed upon a mixture of meal and water. The appearance of the blood thus drawn was greatly altered at each successive abstraction. At the first operation, the cruor was very large, and a considerable portion of hematosine was collected from it; but, as the venesection was repeated, it gradually diminished in bulk, whilst its consistency augmented till the fourth bleeding, when it presented the appearance of a small contracted ball immersed in a great quantity of serum.

This experiment was frequently repeated on different animals, and uniformly with the same results; whence it may be fairly inferred that an increase of serum, with a corresponding diminution of crassamentum, is a very constant, if not an invariable effect of the repeated abstraction of this fluid from the system. Dr. Andrews farther ascertained that there is a perceptible decrease of albumen and salts at each bleeding; he states, however, that the diminution is very variable, and that it seldom exceeds one and a half per cent., even after the fourth operation. In the globules a still greater diminution occurs, being not unfrequently reduced to less than one-half their original number. These experiments are unquestionably of a highly interesting nature, and their results are well calculated to lead to useful precepts in practice.

Organic disease of the kidney is another of those conditions in which there is a deficiency of albumen with a consequent diminution of specific gravity. The reason of this is obvious. In nearly all cases of this disorder, the serum is deprived of its animal principles, and the urine, which is loaded with them,

<sup>\*</sup> No. 63, p. 229.

<sup>†</sup> *London Medical Gazette*, vol. xv., p. 592.

is readily coagulable by heat, alcohol, and acids. Dr. Barlow, of London, who has devoted much attention to the examination of the blood and urine in organic disease of the kidney, ascertained that the specific gravity of the serum is sometimes as low as 1·013, and seldom higher than 1·020. These results coincide with those of Dr. Babington,\* who states that, in what the French have called "Bright's disease," he has invariably found this fluid much below the healthy standard. In a case of this kind there was nearly one-eighth as much albumen in the urine as in the serum, and the patient lost as much of this constituent daily as if he had been bled to the extent of four ounces. In cholera, on the other hand, the watery portion of the blood being drained off, the serum which remains is of high specific gravity, and contains nearly double the ordinary proportion of albumen. Jaundice, as was long ago observed by John Hunter, is another disease in which this fluid is morbidly affected. In this condition of the system, it is not unusual, indeed, to find the serum, as well as the urine, of a deep orange color.

How far, or in what respects, the saline ingredients of the serum are liable to be altered, are points concerning which we have no accurate information. That they frequently exist, in excess as well as in defect, does not admit of reasonable doubt. The ill effects resulting from the long continued use of salt provisions are familiar to every army and navy surgeon. Inflammatory fever, irritable ulcers, itch, and tetter, with other highly distressing and troublesome disorders, are often directly chargeable to such a mode of life. On the other hand, in scurvy, Asiatic cholera, and in the malignant fever of tropical climates, it is extremely probable, as has been observed by Dr. Stevens, O'Shaughnessy, and others, that there is generally a great deficiency of saline ingredients. In these disorders, the hematosine remains dark even in an atmosphere of pure oxygen; but on the addition of a solution of muriate of soda, instantly assumes a florid hue; and this is said to take place even when the solution is very weak. Frequent bleeding, as we have already seen, has also the effect of sensibly diminishing the saline matter of the blood. On the whole, it must be confessed that our knowledge concerning this subject is extremely meagre and imperfect, and numerous researches and chemical experiments will have to be made before we can hope to arrive at any satisfactory or useful results.

That the blood, considered as a mass, may be variously affected, is equally true as of its several constituents. All such changes, whatever they may be, should be carefully studied, as they correspond with so many particular morbid states of the system. Andral has cited numerous cases in which the blood not only contained the different elements of the secreted fluids, but likewise a variety of other accidental products, such as pus, entozoa, and encephaloid matter. In whatever way these substances may gain admission into the vessels, or in whatever mode they may be there developed — and concerning which I do not feel disposed here to speculate — certain it is, that, by combining with the blood, they not only vitiate it, but sometimes completely alter its physical, chemical, and vital properties. From the recent observations of some of the English and French anatomists, little doubt can be entertained that the elements of what are termed the heterologous formations, have their origin in the circulation, and that they are deposited subsequently in the various organs and textures, like other substances, by a sort of perverted action, induced by their presence.

The ill effects of contaminated blood on the solids are well illustrated in the operation of transfusion. This operation, which was invented by Lower,

\* *Cyclopedia of Anatomy and Physiology*. part v., p. 426.



in 1665, consists in transferring the blood of one animal into the veins of another, and has recently been performed, with complete success, by several European practitioners. That no detriment, however, may accrue from this source, it is absolutely necessary that the fluid thus used should be of a healthy character, otherwise it will invariably act as a poison. Of the truth of this assertion there can be no reasonable doubt, as it has been fully established by experiments on the inferior animals, to say nothing of the innumerable instances in which this effect has been witnessed in the human subject. The first case I shall refer to is one recorded by Dr. Gendrin, of Paris, a gentleman of acknowledged veracity, great talents, extraordinary professional attainments, and well known as the author of several admirable treatises on medicine and morbid anatomy. A man, a slayer by occupation, was affected with putrid fever, attended with excessive prostration of strength, gangrenous pustules, and hemorrhagic exudations from the mouth and nostrils. His breath, faecal discharges, and, in fact, his whole body, exhaled a most offensive odor; and the blood which was taken from the arm was unusually black, scarcely coagulated, and displayed a remarkable tendency to decomposition, being already quite fetid at the end of three hours and a half. Under these circumstances the vein was re-opened, and an ounce of blood being drawn, it was introduced into the cellular tissue of the groin of a cat. The animal was soon seized with copious vomiting, followed by dyspnœa, thirst, and extreme prostration, and, in less than seven hours, it expired in convulsions. On inspection, the different viscera were found in a state of congestion and ecchymosis; the heart was soft and flabby; the blood was every where black and uncoagulated; the left pleuritic sac contained several ounces of sero-sanguinolent fluid; and the whole body emitted a nasty, fetid odor, and speedily began to putrefy. A small quantity of blood, taken from the same patient, was next injected into the femoral vein of a dog. Similar phenomena ensued as in the preceding case; the animal soon died from the effects of the morbid fluid. The same distinguished writer details some experiments which he performed with the blood of persons affected with confluent small-pox. In a very short time the most violent effects arose, and the dogs, the subjects of the investigations, usually died in from twenty to thirty hours, in consequence, apparently, of inflammation of the principal internal viscera. On repeating this experiment, some years ago, upon a cat, no unpleasant effects followed; from which it may be inferred that this sort of blood does not always possess noxious properties.

To these experiments may be annexed the extraordinary case related by Du Hamel, of a butcher, who died of malignant pustule, four days after having held in his mouth the knife with which he had slaughtered an over-driven ox. Another person lost his life by accidentally pricking his hand with a bone of the same animal; and two women suffered severely merely from some drops of blood falling on them.

Not less conclusive are the results of the experiments of Dupuy and Lauret. These physiologists assure us that, on introducing blood, taken from a horse affected with malignant carbuncle, into the veins and cellular tissue of another, they have frequently succeeded in inducing the disease. In like manner, glanders have been communicated by Professor Coleman, of London; and we are informed, by Dr. Hertrich, of Berlin, that hydrophobia can be readily produced by inoculating a sound animal with the blood of one that is rabid. A peculiar disease of the dog, called mange, has been transferred in the same way. These facts are highly interesting, inasmuch as they throw light on another subject, namely, the propagation of exanthematous affections by artificial means.

As the blood, in the examples above quoted, was capable of transmitting similar affections, no doubt can be entertained that it was really contaminated ; and there is, moreover, the strongest ground for believing that fatal disturbance is often induced in this way, where we are little prepared to expect it, for aught we can discover in this fluid. The experiments, indeed, of Drs. Christison, Coindet, and others, of injecting poisonous substances into the veins of animals, conclusively show that, although the smallest quantity will frequently destroy life, yet the most delicate chemical tests will be insufficient to detect their presence in the vital current.

Inordinate acceleration of the circulation appears to be often followed by serious alterations of the blood. It was long ago remarked by Haller — and the observation has been repeatedly made by others — that violent muscular exertion will vitiate this fluid, render the perspiration strong and offensive, change the qualities of the urine, and terminate, if long continued, in intense fever, and even death. Dupuy, of France, has ascertained by experiments that the fibrin is either very sensibly diminished or otherwise altered, in animals that are subjected to excessive exercise ; and the celebrated Chaussier assures us, that the transfusion of the blood, under such circumstances, will be speedily followed by the development of gangrenous pustules and malignant fever. The deleterious effect on the blood produced by over-driving animals is well illustrated by the case narrated by Du Hamel, detailed in a preceding paragraph, and is still further exhibited in an instance which occurred in our own country. The case to which I refer is this : A few years ago, a number of fattened cattle were driven into one of the New England cities, and, having been pressed too hard in a sultry day, were so overheated, that some of them became quite exhausted. In this condition they were slaughtered, and the consequence was, as is stated by the reporter of the case, Dr. Fountain,\* that nearly all who partook of their flesh were seized with typhus fever.

In Asiatic cholera, again, in fevers, and other maladies, the blood, contemplated as a mass, is very materially altered ; but whether primarily or consecutively, is a question by no means decided. In the first of these singular disorders, the fluid is drained of its water, and consequently contains a disproportionate amount of albumen, fibrin, and hematosine ; its color is excessively black, both in the veins and in the arteries ; it coagulates very imperfectly ; is greatly augmented in specific gravity ; and the saline matter occasionally wholly disappears. One of the most extraordinary circumstances connected with the blood of cholera subjects is the presence of urea ; this substance, however, is not always found, and, according to Dr. O'Shaughnessy, it is usually most abundant where there is marked and long-continued suppression of urine.

The great diminution of the serum of cholera blood is easily accounted for by the rice-fluid discharges, which are often so excessively copious in this disease, and which are essentially composed of the same elementary principles, namely, water, animal matter, and neutral salts. According to the analysis of Lecanu, the most elaborate that has yet been furnished, it contains neither caseum, nor bile, nor albumen, except in the form of flakes suspended in the ejected liquor.

The blood of fever patients has recently attracted a considerable share of attention among practical writers ; but as yet our knowledge in relation to this subject is both limited and imperfect. In those who died of typhus at Brest, in 1757, the blood is said to have been grumous, black, and decom-

\* Transactions of the Medical Society of the State of New York, vol. ii., p. 219. Albany, 1837.

posed, particularly in the portal vessels; and Dr. Tweedie, in his "Clinical Illustrations of Fever," states that the crassamentum of the blood in this class of diseases, instead of forming a firm coagulum, is unusually soft, scarcely of the consistence of half-boiled currant jelly, preternaturally small, and so destitute of cohesive power as to break on the slightest touch. In the typhus fever of Philadelphia, Dr. Gerhard\* found the blood drawn during life, even at an early stage of the disease, of a very dark color, free from buffy coat, and with a large, soft coagulum. At a more advanced period, it exhibited the dissolved appearance described by various authors as characteristic of typhus or putrid fever. The blood, contained in the heart and arteries, was still more strikingly altered. In one case it is said to have been of the color and consistence of molasses, with minute fatty globules floating in it.

In typhoid fever the most frequent alterations in the character of the blood are, the imperfect formation of the buffy coat, the peculiar state of the clot, and the diminution of the natural proportion of fibrin. In one hundred and eleven bleedings, of which accurate notes were kept by Raciborski,† the buffy coat was entirely absent in forty-six, or existed merely in small, viscid, semi-transparent patches. The clot in all was more or less dark, frothy, and so soft as to break down under the slightest pressure, or even under its own weight. The serum was always diminished in quantity, and without being actually turbid, was never so clear as in recent inflammation. In all these bleedings, which were performed upon twenty-one patients, the buffy coat was not complete in a single one. The results of these observations are confirmed by the researches of Louis, Chomel, Bouillaud, Andral and Gavarret. All these writers testify to the black, grumous, and imperfectly coagulated condition of the clot, and the infrequency of the buffy coat. When present, the latter is usually very thin, soft, gelatinous, or infiltrated, and of a greyish, greenish, or iridescent, semi-transparent appearance. The blood in the cavities of the heart is either entirely fluid, or it presents itself in the form of dark coagula, or, finally, it is converted into whitish or yellowish concretions. The proportion of fibrin is never augmented above the natural standard; on the contrary, it is generally very considerably diminished, especially in severe cases. The globules are less numerous than in healthy blood, but, in proportion to the quantity of fibrin, they always exist in a redundant state.

In the *yellow fever* of Philadelphia, in 1797, Dr. Rush‡ found the blood frequently quite dissolved, dark, grumous, and occasionally like the washings of flesh. In some of the cases the serum had a yellow color; and, towards the close of the disease, it was very common to see the *crur* more or less sized. This appearance, it would seem, generally portended a favorable issue. Similar states of the blood have been noticed by Ariquila, Bally, Palloni, and others, in the epidemic yellow fever of Spain; and, more recently, by Dr. Copland and Dr. Stevens, in the same disease, as it occurred in the West Indies. These authors describe the blood of yellow fever patients as semi-concrete, of a dark color, very poor in regard to its fibrous and saline constituents, and extremely prone to decomposition. A state very analogous to this is observed in the plague, in epidemic peritonitis, and in the worst forms of erysipelas.

Our knowledge of the alterations which the blood experiences in those who die of plague is still extremely defective. This disease is usually very rapid in its march, and is characterized by the development of buboes, livid patches on

\* Amer. Jour. Med. Scien., vol. xx., p. 298.

† Gazette Medicale, Feb. 1839.

‡ Medical Inquiries, vol. ii., p. 13.



the skin, great congestion of the viscera, and effusions in the internal cavities. According to Dr. Bulard,\* of Turkey, the blood occasionally remains perfectly fluid, and never exhibits the buffy coat; it is unusually cohesive as it flows from the vein, and not unfrequently emits a peculiar odor. It was analyzed in three cases, and found to contain in 100 parts the following ingredients:

Clot	{	Water	-	-	-	-	35.576
		Fibrin	-	-	-	-	00.624
		Coloring matter, with some fibrin, albumen, and fatty substances	-	-	-	-	3.800
Serum	{	Water	-	-	-	-	54.420
		Albumen and coloring matter	-	-	-	-	4.704
		Extractive	-	-	-	-	00.252
		Chloride of potassium and sodium	-	-	-	-	00.408
		Carbonate of soda and fatty matters	-	-	-	-	00.216
		Distinct traces of sulphurous acid.	-	-	-	-	

In plethora the blood is unusually florid, the serum is more or less discolored, and the clot, which rarely exhibits the buffy coat, is large, and of moderate firmness. The fibrin is not sensibly augmented; it remains within the natural limits, and does not even tend, in the greater number of cases, to mount to the highest standard. The serum is much diminished in quantity, but its organic materials do not present any particular change of proportions. The globules alone are in excess, and it is this circumstance which establishes, as far as it respects the blood, the character of plethora. In thirty-one bleedings performed by Andral,† the globules stood at 141 as the average, at 131 as the minimum, and 154 as the maximum.

In anæmia, the reverse of plethora, the clot is very small, and floats in an abundant, colorless serum. Instead of being soft, as might be expected, it is exceedingly dense, coherent, and often covered by a characteristic buff. This state of the clot is the more marked in proportion as the anæmia is more thoroughly established. In confirmed cases the blood may even be cupped, as was pointed out long ago by Borsieri. The fundamental character of anæmia consists in a diminution of the globules, which often fall far below the normal limits. Thus Andral‡ found, as the average of the proportion of the globules, in sixteen cases of incipient anæmia the cipher 109, and in twenty-four cases of confirmed anæmia the cipher 65. In the spontaneous form of the disease the fibrin and solid matters of the serum may retain their normal relations; but when it supervenes on copious hemorrhages they are generally sensibly diminished. In a female, who had experienced repeated attacks of menorrhagia, the blood contained only 21 in the thousand of globules, 1.8 of fibrin, and 61 of solid matters of the serum, the proportion of water being 915.

In chlorosis, which may be viewed as the most perfect type of anæmia, the blood always experiences great changes, both as it regards its color, its consistence, and the relative proportion of its ingredients. It is almost always remarkably impoverished, and it is to this circumstance that is to be ascribed the blanched appearance of the skin, with the diminished temperature which form such prominent features in its history. In the violent degrees of this malady, the crassamentum is soft and small, the serum thin and copious, and

\* British and Foreign Med. Rev., vol. viii., p. 551.

† Op. cit., p. 40.

‡ Op. cit. p. 43-52.

the hematosine so pale as scarcely to leave a stain when dropped on white linen. From an examination of two specimens of chlorotic blood, by Mr. Jenkins, of England, it would appear that the albumen and salts exist in the usual proportions; but that there is a considerable increase of water, and a very great diminution of coloring matter, to the amount nearly of two-fifths.

*Jaundice* is another disease, in which, as was formerly stated, the blood is more or less altered in its properties. Not only the coloring principle of the bile, but even the resin of this substance has been detected in the circulation; and, as a necessary consequence, especially when the disease is of long continuance, every tissue of the body assumes a yellowish tinge, as well as, in many cases, the different secretions. In four subjects that I have had occasion to dissect within the last five years, all the soft parts, together with the whole of the osseous and cartilaginous systems, were of a deep orange complexion, from this cause. Even the brain participated in the change; for its substance was by no means of so clear a white as in the healthy state. When the bile is thus introduced into the general circulation, it appears to act as a sort of narcotic, inducing drowsiness and irritability. In other cases it generates fever, with headache, nausea, and loss of appetite. The presence of this fluid may be easily detected in the serum of the blood by adding to it an equal quantity of sulphuric acid, diluted with twice its bulk of water. The serum will thus change its yellow straw color for the characteristic green tint of bile.

But in no deranged condition of the body is the blood more remarkably altered than in *scurvy*. This fact, although long ago noticed by physicians, appears to have been first placed in its true light by Dr. Mead, of Dublin. In his medical works, published in 1767, it is distinctly announced that the blood of persons laboring under this disorder is always unnaturally black, greatly deficient in cohesive power, and manifests no disposition whatever to separate into serum and crassamentum. In the latter stages of the malady, the fluid had frequently the aspect and consistence of thin tar, treacle, or even of ink, the fibrin looking like wool floating in a dark, muddy substance, sometimes of a greenish tint. The blood that oozed from the mucous surfaces, in the form of spontaneous hemorrhage, exhibited similar appearances, showing, most conclusively, that it had undergone essential changes, both in its chemical properties and in its vital affinities.

The blood is generally considerably altered in pulmonary phthisis. Among the changes which occur in the progress of this affection, there is none more constant than an impoverished condition of this fluid, which is thin, light colored, and deficient in globules. The diminution of the globules is apparent, according to Andral, at the very commencement of the morbid deposit, and reaches its minimum when the lungs are filled with cavities. The fibrin is not changed as long as the tubercles remain crude, and there is no inflammation in the parts around them. The very moment, however, the softening process begins, it increases in quantity, and so continues until the disease arrives at its third stage, when it attains its maximum. Andral weighed the fibrin obtained from thirty tubercular patients in thirty-three different bleedings. In seven of these the tubercles were crude, in nine they were softening, and in fourteen they were converted into abscesses.

The seven patients of the first series were bled, altogether, nine times; in seven times the fibrin was found normal; and twice it exceeded the physiological standard, giving the numbers 4.8 and 5.1. It is worthy of note, however, that in each of these two cases there was an inflammatory complication. In ten bleedings performed on the nine patients of the second order, that is, when the tubercles were in a state of softening, the fibrin was in excess in all,

excepting one, sometimes very slightly, hardly reaching 4, and sometimes varying between 4 and 5. In the fourteen cases of the third class, this substance was in excess twelve times, and that in a much greater degree than in the second series. The minimum was 4.0; the maximum 5.9.

The clot in the early stage of this disease is generally rather small and dense, but does not exhibit any other peculiarities. When softening sets in, or cavities begin to form, it diminishes very sensibly, and is almost always covered with a buffy coat. Andral states that in the advanced stage of phthisis, the latter phenomenon is nearly as constant as in pneumonia, or acute articular rheumatism.

The researches of Andral do not throw much light on the condition of the blood in carcinoma. From the cases, however, which he has collected on the subject, he is led to infer that here, as in tubercle, the fibrin does not increase until the matter is advancing to, or has actually reached, its stage of softening and destruction. The globules offer nothing remarkable, except the progressive diminution they undergo in consequence of the defective nutrition and profuse hemorrhages so generally attendant upon the disease.

To the instances now cited, numerous others might be added, equally striking and satisfactory, in which the vital fluid is most seriously altered, and transformed into a substance very different in its character from that observable in the healthy state of the economy. But to do this would far transcend the limits of the present work, and would be literally writing a treatise on individual maladies, — a task which I do not feel disposed, even if this were the proper place, to undertake. From the facts that have been presented on this interesting subject, it cannot be doubted, by any one who duly and impartially contemplates it, that the blood is a fruitful source of disease, or, in other words, that it is susceptible of various morbid impressions, of which, in many instances, it is the primary and original seat. Considering the vast surface from which the chyloferous vessels imbibe the nutritious matter, and the heterogeneous nature of our food and drink, it is highly probable that the elements of disease may thus readily find their way into the current of the circulation, and establish a prejudicial action in the solids, by which they in turn are disordered, and thrown into commotions incompatible with the harmony and well being of the general system or of some of its numerous members, tied together as they all are, figuratively speaking, by the closest consanguinity.

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## CHAPTER II.

### OF THE CELLULAR TEXTURE.

Distribution. — Physical Characters. — Organization. — Physiological Properties. — Lesions. — Acute Inflammation. — Suppuration. — Gangrene. — Chronic Inflammation. — Induration. — Serous Infiltration. — Emphysema. — Degenerations. — Foreign Substances. — Guinea Worm.

THERE is no tissue which is so extensively and universally diffused as the cellular. Occurring in every organ of the body, it not only contributes materially to its composition, but serves the important purpose of cementing together its several anatomical elements, and binding them up into one united whole. In quantity it varies very much in different situations, being extremely abundant in some, and almost entirely wanting in others. There is a great deal of it immediately beneath the skin, especially in the groin and axilla,



in the mediastinal cavities, the abdomen, and pelvis. The vessels have likewise a considerable share of it; the lungs are well supplied with it; and a large quantity of it is always found among the voluntary muscles. On the other hand, there is very little cellular tissue in the heart, liver, spleen, and kidney; in the uterus, ovary, testicle, and penis; in the tendons, ligaments, and fibrous membranes. None exists, except in a combined state, in the bones, cartilages, and cerebro-spinal axis.

In regard to its density, this substance likewise presents considerable variation in different regions of the body. Generally speaking, this property may be said to be in direct ratio to the quantity of the tissue, being very slight in those situations which abound in it, and very great wherever there is a scarcity of it. It is very lax beneath the skin, except at the mesial line, and around most of the internal viscera. The same arrangement obtains in the muscles; but, as this substance penetrates into their interior, it becomes gradually more dense, short, and delicate, until it finally escapes observation. Under the skin, the cellular tissue is spread out in the form of a lamella, which can be traced as a continuous whole from one region of the body to the other, and which constitutes what, in surgical language, is denominated a fascia. It may also be stated here that this substance receives different names, according to the organ with which it is associated, as subcutaneous, retro-peritonæal, submucous, inter-muscular, and subserous. The peculiarities which it exhibits in these localities will be pointed out in their proper places.

The cellular texture is highly extensible and elastic, and is thus well qualified to discharge the various functions that have been assigned to it in the animal economy. Another property possessed by it is the hygrometric, by virtue of which it expands and regains its primitive softness and pliancy, when immersed in water after having been dried. It is composed principally of albumen, in union with a little gelatine, the quantity of which is always less in the old than in the young. It resists putrefaction for a long period, and is not easily broken down by boiling. Exposed to destructive analysis, it yields oxygen, hydrogen, carbon, and azote. The cellular substance is every where lubricated by a thin watery fluid, the presence of which is essential to the due exercise of its healthy functions; it is of an albuminous nature, and identical with the serum of the blood, whence it is derived.

Examined in reference to its structure (Fig. 48), this tissue is found to be

Fig. 48.



composed of whitish filaments, homogeneous, soft, and transparent, which intersect each other in all directions, forming thereby a multitude of cells which freely communicate together over the entire body. Of the many proofs that might be adduced in illustration of the truth of this position, it will suffice to mention that fluids introduced at one point can be readily forced to another, however remotely situated.

In anasarca, the effused water always gravitates towards the most depending part of the limb, where it may be readily discharged by slightly

puncturing the skin. On the same principle, the air in emphysema frequently extends over the whole body, elevating the integuments into a soft, irregular swelling, which emits a peculiar crackling noise on pressure. All these are so many circumstances demonstrating the direct continuity of the cells of the substance in question.

In their shape, the meshes of the cellular substance are too variable to enable us to express any definite opinion respecting it. In some situations, they appear to be of an oval form; in others, they are rounded; in others, cylindrical; in others, angular. In most parts, these figures occur in a state of combination. Equally variable are the dimensions of these cavities. In the normal state, they are quite small, so much so, indeed, that some writers have been induced to deny their existence; but, in certain pathological states, they often acquire a considerable magnitude. The cells can be easily demonstrated by injections of melted glue, or, still better, by distending them with water, and afterwards exposing the part to a freezing mixture. In this way, numerous icicles will be formed, having the form and volume of the cavities which they occupy.

The filaments of which this tissue consists are variously aggregated in different parts of the body. In the glands, they are arranged into a species of framework, into the meshes of which is deposited the substance which imparts to them their characteristic attributes, whilst upon their walls are ramified the vessels and nerves which are required for their support and animation. In the bones, they form a nidus for the reception of earthy matter; in the serous membranes, they present a lamellated disposition, and in the vascular tubes, they are arranged spirally. Thus, these filaments do not merely enter largely into the construction of the various organs, but they actually form the basis of every one of them, no matter what are its essential anatomical elements.

The sensibility of the cellular texture is very obscure in the normal state; but when inflamed, it is often the seat of severe pain. Nervous filaments penetrate it on every side, but they do not appear to be lost in it, for in general they can be traced to some contiguous organ. The same remark is applicable to its blood-vessels and absorbents, the former of which are excessively delicate, and do not convey red fluid in the healthy state. It is also said to receive exhalants, but this is a mere conjecture, unsupported by facts.

The absorbing powers of this texture are very great. Fluids of various kinds, so often effused into its meshes, are rapidly taken up, and eliminated by the kidneys, skin, and other outlets. Some articles of the *materia medica*, placed in contact with it, exhibit their specific action in distant organs in as short a period nearly as when introduced into the stomach. A solution of emetin, injected into the subcutaneous cellular substance of a dog, speedily induces vomiting; morphia, sleep; strychnine, tetanic spasms.

The cellular substance presents certain peculiarities depending upon age. In infancy, it is extremely delicate, soft, spongy, and transparent; in the adult, it is firm, dense, and somewhat opaque; in advanced life, it is remarkably hard, dry, and resisting, not unlike aponeurotic membrane. It likewise loses a considerable share of its elasticity, and hence that withered appearance of the skin which forms so characteristic a trait of old age and decrepitude.

Notwithstanding its apparently unorganized character, the cellular substance possesses the formative power in a very eminent degree. When destroyed, it is speedily regenerated; and, in many instances, it supplies the loss of those textures that cannot be perfectly reproduced, as the muscular and tendinous.

Every growth, in fact, whether normal or accidental, probably begins in the cellular substance.

The cellular tissue, diffused, as we have just seen, through every part of the body, and cementing together its various anatomical elements, is prone to numerous diseases, both of a primary and consecutive nature. Many of these lesions are of a highly interesting character, as affording an admirable insight into some of the most striking processes employed by the animal economy in repairing injuries, and in throwing off from the system such materials as have a tendency to impede the exercise of its normal functions. The principal morbid affections of the cellular tissue, those which demand the special attention of the morbid anatomist, may be comprised under the following heads: 1, acute inflammation, suppuration, and gangrene; 2, chronic inflammation; 3, induration; 4, serous infiltration; 5, emphysema; 6, transformations into other substances; 7, the development of parasitic animals.

I. In *acute inflammation*, the cellular tissue is of a light reddish color, soft, spongy, and inelastic; its cavities are filled with an opaque, gelatinous fluid; and all the vessels ramifying through it are distended with blood. The nerves, too, are increased in their dimensions; and, when the irritation has been violent, it is not unusual to find small extravasations, produced by a real rupture of some of the capillaries. If the part affected contains much adipous matter, this will be variously modified, according to the degree of the inflammation; when moderate, the fat is commonly absorbed; if intense, it is broken down, mixed with the effused blood, and converted into a yellowish, pap-like substance, nearly destitute of its original features. These appearances, which denote a high degree of morbid action, always decrease towards the periphery of the inflammation; the redness also gradually declines in intensity; the vessels are less minutely injected; and the tissue, although somewhat œdematous, preserves its accustomed elasticity and expansibility.

After some time, varying from three to eight days, softening takes place towards the centre of the inflamed mass, and the cells of the tissue become loaded with globules of *pūs*. Subsequently the walls of these interstices are broken down, and the purulent matter is collected into one or more cavities. The swelling, in the mean time, becomes more circumscribed, the surrounding œdema diminishes, and the neighboring cells being agglutinated together by lymph, an effectual barrier is thus presented to the extension of the *pūs*. The cellular substance immediately around the matter is of a dense, compact texture, forming a firm, resisting sac, the inner surface of which, at first red and rough, gradually assumes a smooth, velvety aspect, not unlike mucous membrane.

Such are the ordinary characters, and such the usual termination of circumscribed *phlegmonous* inflammation of the cellular tissue. Another variety, much more formidable than the preceding, because much more destructive in its results, is the *diffuse*, so termed from its spreading tendency. In whatever manner this disease arises, whether from external violence, phlebitis, poisoned wounds, phlegmonous erysipelas, or any other cause, it always attacks a large extent of surface, often invading a whole limb, or even a considerable portion of the trunk. In most cases it terminates in suppuration, and sometimes even in sloughing. The matter, which is generally of an unhealthy, sanious character, is not contained in a sac, nor is it restricted by an effusion of fibrin, as in the phlegmonous form, but is extensively diffused, and often causes great havoc in the adjacent structures.

When diffuse inflammation occurs in debauched, worn-out individuals, as it is apt to do when it presents itself in the form of a carbuncle, it not unfre-



quently terminates in *gangrene*. This disease, which is usually located in parts remote from the centre of the circulation, is characterized by a soft, doughy, undefined swelling, with deep-seated, burning pain, an oppressive sense of weight, and vesication of the cuticle. In a short period, the swelling assumes a dark, brownish, violet or purple color, and imparts a peculiar, boggy feeling, as if the subjacent textures were floating in a fluid. Numerous apertures now appear in different parts of the skin, giving vent to a thin, acrid sanies. If the cellular substance thus affected be examined after death, it will be found to have the appearance very much of wet tow, being of a deep ash-color, soft, inelastic, extensively detached, and bathed in a bloody and offensive fluid. These changes are not always confined to the subcutaneous cellular tissue, in which they more commonly commence. Not unfrequently, long, sinuous tracks are formed between the muscles, and gangrenous shreds are seen hanging from aponeurotic sheaths, tendons, ligaments, and blood-vessels. Sometimes, though rarely, the disorganizing process extends to the periosteum, involving it and the subjacent bone in the destruction. Excessive pain and great constitutional disturbance — at first of an inflammatory, and afterwards of a typhoid character — are the usual attendants of this formidable malady.

II. In *chronic inflammation*, the cellular tissue no longer tears with the same facility as in health: it is dense, hard, and crisp; admits of little extension, and it is nearly destitute of elasticity. When the disease is protracted, the tissue gradually assumes an opaque, milky color, and its cavities are distended with sero-fibrinous matter, so as to be no longer permeable to blood, air, pus, or water. These alterations, which give the seat of the disease a tumid and constricted feature, are well characterized in the callous edges of old ulcers, in chronic erysipelas, in the hard swellings so often witnessed in gouty and rheumatic affections, in *pelagra*, *elephantiasis*, and in the induration of the cellular substance of new-born infants.

This disease seldom produces healthy pus; on the contrary, the matter is commonly of a sanious, sero-purulent, or sanguinolent nature. Occasionally small abscesses are scattered through the affected tissue, containing a yellowish, turbid serum, or thick curdy matter, not unlike that of a strumous lymphatic ganglion. In the subcutaneous cellular substance, these deposits are often enclosed by a thick layer of lymph, by which their contents are kept within their proper sphere. During the development of this sac, the circumjacent tissue is red and indurated; but, as soon as the membrane is organized, as often happens when the irritation is protracted, these phenomena generally disappear, and the parts gradually resume their normal properties. The sac often acquires great thickness and density, layer after layer being deposited upon its internal surface, as is the case with the adventitious membranes in other situations, when they participate in the inflammation of the surrounding structures. This affection is rarely attended with much pain; indeed, were it not for the hardened and inflexible state of the affected part, the patient would experience but little inconvenience.

III. *Induration* of the cellular tissue constitutes a peculiar disease in children, which has been described by writers under the several appellations of *œdematous hardening*, *scleroma*, and *skin-bound*. It was first noticed as a distinct malady in 1718, by a German author of the name of *Uzembezius*. Since that period it has been described, with great accuracy, by *Denman* and *Underwood*, of England, by *Doublet*, *Billard*, and others, of France. The disease is comparatively rare in this country and Great Britain; but, on the continent of Europe, especially in the foundling hospitals of Paris, it is extremely prevalent and fatal, hundreds of infants annually dying with it.

Many children, it would seem, come into the world with this affection, or are attacked within the first twenty-four hours after birth. Its progress is usually very rapid, most of the little patients being cut off in the course of three or four days.

The disorder sometimes affects the whole body; more commonly, however, it is restricted to particular regions, as the abdomen and inferior extremities. The skin is of a brownish color, interspersed with yellowish looking patches, and its texture is remarkably hard and firm, almost like leather. The subcutaneous cellular tissue is very dense and granular, communicating, when cut, the sensation of fibro-cartilage, calf's-foot jelly, or half-dissolved glue. Frequently it is of a bright lemon-color, and contains a large number of dark yellow granules, which are nothing but diseased adipous vesicles. The infiltrated matter is sometimes firm and concrete; but, in the early stages of the disorder it is commonly thin, and straw-colored, like serum, and readily coagulates by heat, alcohol, or dilute acid. The greatest induration is usually met with on the outer surface of the leg, and on the dorsal aspect of the hand and foot.

Associated with these morbid appearances are various lesions of the internal organs. The lungs are hard, increpitous, marbled, and congested; the oval foramen and arterial duct often remain patulous, or are but partially closed; the liver is extremely vascular, and the gall-bladder is distended with vitiated bile; the mesenteric glands are enlarged and injected; the gastro-enteric mucous lining more or less inflamed; and the whole venous system remarkably engorged with blood. Various opinions have been suggested respecting the precise nature of this affection; but the most plausible, decidedly, is that which ascribes it to inflammatory irritation, either of an acute or chronic character, which determines an effusion of sero-fibrinous matter into the meshes of the cellular tissue, closing up its cavities and hardening its texture.

IV. The cellular tissue is liable to various *morbid growths*, deposits, and transformations. Amongst these the most common are cysts, melanosis, and fungus hæmatodes, neither of which will require particular notice in this place. Fibrous, cartilaginous, and bony formations are most prone to occur in the sub-serous cellular tissue of the chest, abdomen, and scrotum, in small grains, patches, or irregular incrustations. Such degenerations are extremely rare in the cellular tissue under the skin, and still more, if possible, in that of the mucous membranes.

V. *Serous infiltrations* of the cellular tissue are very common in persons of deteriorated constitutions, and in those who have become exhausted by protracted diseases, profuse hemorrhages, and other affections impairing the vital powers. In poisoned wounds, the effusion is generally very rapid, large in quantity, and highly acrid in quality. Various terms have been employed to designate this condition of the cellular tissue. Thus, when it is restricted to a particular region, as, for instance, the eyelid, leg, or scrotum, it is named *œdema*; whilst, when it is more extensive, or diffused over the greater part of the body, it is called *anasarca*. Neither of these appellations, it is obvious, is well chosen, as the one literally signifies merely a swelling, the other dropsy of the flesh. The interstices of the cellular tissue in this disorder are very much enlarged, and the skin over the part, which has generally a singularly glossy and tumid appearance, readily pits upon pressure. The effused fluid is of a sero-albuminous nature, is coagulable by heat, alcohol and acids, and occasionally undergoes spontaneous concretion. These serous infiltrations, in whatever part of the body they occur, ought to be regarded as the result of capillary congestion, depending upon inflammation, debility, or mechanical obstruction.

VI. *Hemorrhage* always arises from a rupture of the blood-vessels, produced by external violence, or by some internal cause, the precise nature of which is not so well understood. In the former case, the fluid, although sometimes widely diffused, generally forms an elastic, circumscribed tumor, technically denominated an *ecchymosis*; in the latter, it is more commonly seen in small patches of a dark purple color, which have received the name of *suggillations*, death-marks, or cadaveric lividities. These spots, which are always most conspicuous on the posterior parts of the body, are very distinct in persons who die from petechial fevers, the plague, and the scurvy, and can be readily distinguished from ecchymoses by the entire absence of all signs of violence. Suggillations, however, do not always arise exclusively in the manner here indicated. In many instances, if not in most, they result entirely from an accumulation of blood in the capillary vessels of the skin and cellular tissue, without any extravasation whatever. These facts should be borne in mind, as they have a most important bearing upon legal medicine. For the want of correct information upon this subject, errors the most serious have sometimes been committed by physicians.

VII. *Emphysema* may be produced by a great variety of causes, but the most common are penetrating wounds of the chest and rupture of the air-cells of the lungs, from violent coughing, or ulceration, and injury of the lining membrane of the windpipe. Dr. Baillie supposes that it sometimes arises spontaneously, as the result of a process of secretion from the blood-vessels; and, in a considerable number of cases, it has been met with as an attendant on gangrene. The infiltration is sometimes very great, the air occupying nearly the whole of the cellular tissue. The distended parts have a bloated aspect, pit under the finger, and emit a peculiar crepitating sound, when pressed, not unlike the lungs.

VIII. *Foreign substances* are sometimes found in the cellular tissue. In most cases they excite inflammation in the contiguous parts, and are finally discharged by suppuration. Not unfrequently, however, especially when they get admission through the alimentary tube, they become encysted; that is, the cellular tissue is condensed around them, and converted into a sac. At other times, again, after traversing the body in different directions, they are arrested, and work their way out through the skin, generally at the back of the hand and foot, though in this respect there is no invariable rule. It is thus that bullets and needles often pervade the subcutaneous cellular tissue, starting, perhaps, at the trunk, and gradually reaching the most distant parts of the extremities, and this, too, frequently without producing any serious mischief. Not long ago, a case occurred in one of the Parisian hospitals, where the cellular substance was literally loaded with needles, and yet the patient lived several years in tolerable comfort.

IX. The cellular tissue is occasionally the residence of *parasitic animals*, developed either in its substance, or introduced from without. Of these, the only one requiring notice is the *filaria medinensis* (Fig. 49), the little dragon, or Guinea-worm. This animal, which is extremely simple in its structure,



Fig. 49.  
a, Head; b, caudal extremity.



generally occurs immediately beneath the skin. The legs and feet are the parts which it more commonly infests, but it has also been observed in the scrotum, the anus, and in different parts of the head and trunk. It is of a white color, about the thickness of a violin-string, and, when full-grown, from five to ten inches in length; its diameter being nearly equal from one end to the other, except towards the tail, which is somewhat tapering and curled. The countries in which these worms most frequently occur, are Egypt, Arabia, Guinea, Persia, and Abyssinia. Several of them have been known to co-exist in the same patient; and occasionally they have been found from three to four feet in length.

## CHAPTER III.

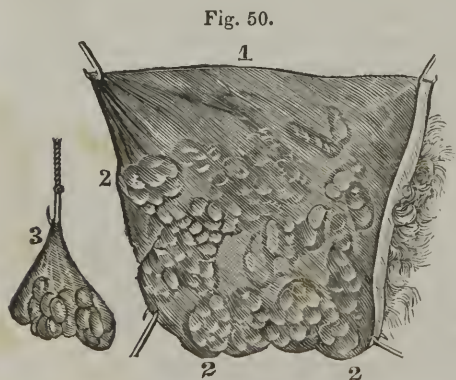
### OF THE ADIPOUS TEXTURE.

Organization. — Exists only in particular regions of the Body. — Office of the Adipous Vesicles. — Nature and Uses of the Fat. — Lesions of the Adipous Tissue. — Wounds. — Liability to Inflammation. — Hypertrophy, general and local. — Adipous Diathesis. — Atrophy.

THE adipous texture consists of an infinite number of vesicles, which are variously arranged in different regions of the body, and the diameter of which scarcely exceeds the eight-hundredth part of an inch. In their natural state, these little reservoirs are of a spherical shape, and so closely agglomerated as to resemble clusters of fish-spawn; but, when their contents are partially absorbed, they assume a flattened appearance; and in great emaciation it is often impossible to distinguish them from the cellular substance in which they are immersed.

The parietes of the adipous vesicles are formed out of the cellular element: they are excessively delicate, and so transparent as to render it difficult to distinguish them, even with the aid of a magnifying glass, from their own contents. Each reservoir receives an arterial and venous branch, together with a nervous filament and a lymphatic vessel, by which it is attached, as by a sort of foot-stalk, to those immediately around it. The precise arrangement of these structures is not ascertained, but it is probably not different from what it is in other parts of the body.

Modern researches have disclosed that these little vesicles (Fig. 50), do not communicate together, as was formerly supposed by anatomists and physiologists. They are, indeed, perfectly distinct, the one from the other, and hence the fat which they contain never escapes until they are ruptured. If it were not for this arrangement, the contents of these reservoirs would be constantly liable to extravasation, and, like the water of anasarca, gravitate towards the most depending parts of the body, interfering thereby not only with the freedom of its movements, but leading to the most hideous deformity.



1, Portion of adipous tissue; 2, minute bags containing fat; 3, cluster of bags separated and suspended.

The texture before us does not, like the cellular, exist in all parts of the body. There is none in the parenchy-

matous and glandular organs, in the cartilages, tendons, fibrous membranes, and lymphatic ganglions. The lids and the eye, the scrotum and penis, the uterus, clitoris, and nymphæ, are also deprived of it. The brain has no adipous substance, at least not in a free state; and the same is true of the spinal cord, together with most of the nerves. On the other hand, it generally exists in great abundance in the subcutaneous cellular tissue, in the orbits, about the kidneys, in the folds of the peritonæum, and in the interior of the long bones, where it constitutes what is vulgarly called the marrow. There is frequently a considerable quantity around the heart and great vessels, particularly in old, corpulent subjects, and the larger intervals between the muscles are usually filled with it.

In its mode of arrangement, the adipous tissue exhibits considerable diversity, according to the locality in which it is examined. Under the skin, it is spread out in the form of a lamella, the thickness and density of which vary in different parts of the body, as well as in different individuals. In the orbit of the eye, and on the cheek, it occurs in rounded packets, whilst in other situations, as in the great omentum, it presents itself in narrow, band-like strips, or in the form of pedunculated masses, as in the epiploic appendages.

The office of the adipous vesicles is to deposit the fatty matter which they contain. How this elaboration is effected it is needless to inquire; for beyond the mere circumstance of the elements of this substance being found in the blood, nothing whatever is known. The process by which these elements are combined, so as to form the adeps, is still enveloped in mystery, if, indeed, it is susceptible of explanation. Oil and fat have been detected in the general circulating mass by Traill, Thackrah, Chevreul, Lecanu, and other experimentalists; and it is not improbable, therefore, that the office of the arterial capillaries of the adipous vesicles simply consists in evolving the principles of these substances from the fluid with which they are incorporated.

The fatty matter, considered apart from its containing vesicles, is of a light yellowish tint, owing to the presence of a peculiar coloring principle, which is easily removed by washing. During life it varies in its consistence, from the condition of a liquid to that of a semi-concrete substance, being naturally softer in some parts of the body than in others. After death, it is always more solid. Possessing all the characters of the fixed oils, it is specifically lighter than water, has a mild, insipid taste, and is completely inodorous when fresh, but soon becomes rancid and offensive by exposure to air and heat. Fat is one of the few animal substances which do not contain azote. We learn from the experiments of M. Chevreul, a French chemist, that it is formed of two proximate principles, elaine and stearine, the former of which is of a fluid consistence and an oily nature; the latter solid, white, rather shining, and easily fused when heated. The relative proportions of these materials vary in different parts of the body. The marrow of the bones appears to be almost entirely composed of elaine.

Besides serving as a sort of aliment in reserve, the fat moderates in certain regions the effects of pressure, fills up the voids between the muscles and skin, and probably assists in preserving the temperature of the body. That it contributes to the production of this latter result, may be inferred both from the circumstance of the fat being a bad conductor of caloric, and from the fact that almost all arctic quadrupeds are abundantly supplied with it, — Providence thus enabling them to defy the most dreadful extremities of cold, and to sustain a high temperature even under the eternal ice of the poles. But the most important use of the adeps is the part which it performs in the nourishment of the system, when the stomach is temporarily disqualified from carrying

on the digestive function, in consequence of local or general disease. The adipous vesicles, in such cases, are robbed of their contents, which, being taken up by the absorbents, are conveyed into the circulating current, to be re-converted into blood. It is owing to this removal of the fat that persons recovering from painful and protracted indisposition have such a constant desire for food, being tormented, if I may so express myself, with an omnipresent appetite. The demands of the system, under such circumstances, are of the most urgent nature, every adipous vesicle, every fibre, and every organ calling aloud, as it were, for nourishment, and for a share of the fatty matter which it contributed to the support of the body, at a time when the digestive apparatus, languid and oppressed with disease, was incapable of performing its accustomed functions. The same thing is beautifully exemplified in hibernating animals, which are very fat on retiring to their winter quarters, but are always lean on the return of spring, when they awaken from their torpid state.

*Wounds* of the adipous tissue present nothing unusual in their mode of healing: they commonly unite without difficulty, in fact, not unfrequently by the first intention. When the divided parts are kept asunder, the fatty matter is gradually absorbed, and the restoration is finally effected by the granulating process, as in similar injuries of other textures.

It has been questioned by some, whether the adipous tissue is susceptible of *inflammation*, the opinion having arisen, probably from the belief at one time very current among physiologists, that this substance is not endowed with a sufficient degree of vitality for this process to take place. In endeavoring to solve this problem, the reader should bear in mind the distinction between the adipous tissue, properly so called, and the fat. The one, as has been already seen, is an organized substance, provided with blood-vessels, nerves, and absorbents, and is, therefore, liable to the different kinds of inflammation; the other, on the contrary, being inorganic, must, of course, be insusceptible of morbid action. In acute inflammation, the adipous tissue assumes a dark reddish aspect, and always manifests a peculiar tendency to slough, in consequence, it would seem, of its vascular and nervous endowments being too feeble to offer the necessary resistance. In peritonitis, I have several times seen the fatty omentum inflamed in one part, and gangrenous in another, though there was little effusion of lymph or serum.

The adipous tissue is liable to *hypertrophy*. This may be either general or partial. Various attempts have been made to estimate the standard amount of fat; but, as the quantity varies in different individuals, and even in the same person, under different circumstances of health and disease, it is obvious that there must be great difficulty in arriving at a satisfactory conclusion. The majority of anatomists, however, agree in the opinion that, in an adult of ordinary size, it forms about one-twentieth part of the entire body. Thus, a man weighing one hundred and sixty pounds, would have about eight pounds of fat. But, in cases of obesity, it often greatly exceeds this quantity; and, on the other hand, in emaciation it often falls far below it. In general hypertrophy, the quantity of fat is sometimes enormous, amounting to five or six times the weight of the entire body. The celebrated Pritchard, of Kentucky, who exhibited himself in Litton's museum, in Cincinnati, in 1834, weighed five hundred and fifty pounds. The Canadian giant, as he was called, whom I saw in Philadelphia, in 1829, weighed six hundred and eighteen pounds. He was six feet four inches in height, and the circumference of each leg, around the calf, was nearly three feet. The most remarkable feature in this case was, that this enormous deposit of fat, making him so much larger than ordinary men of the same stature, was confined chiefly to the abdomen and lower extremities, the thorax, shoulders and arms being little stouter than in other



persons. Daniel Lambert, of England, who died at the age of forty, weighed seven hundred and thirty-nine pounds; and the German journals give the case of a man who weighed eight hundred pounds. The individual was carried off by fright, and, on inspection, the fat of the abdomen was found to be nearly fourteen inches thick. An account of a somewhat similar case has been published by Dupuytren. The individual, a poor beggar-woman, measured five feet one inch in height, and five feet two inches in circumference. The thoracic and abdominal cavities were enormously loaded with adeps; on the mammæ, the subcutaneous layer was seven inches in thickness. But the most extraordinary example of this affection, of which I have any knowledge, has recently occurred in the State of New York, in a girl that weighed three hundred and sixty-four pounds, though only ten years and a half old.

There would thus seem to be, from the above detail of cases, sometimes a real adipous diathesis, nearly all the materials entering the circulating mass being converted into fat. Various articles of food and drink have a tendency to bring about this state of the system. Malt liquors, taken to excess, and the moderate use of wine and ardent spirits, are, perhaps, the most powerful means for producing general hypertrophy of the adipous tissue. But, whatever may be the exciting causes of these depositions, certain it is, that indolence and freedom from care are necessary, if not essential, to the process. Castration is generally followed by considerable obesity; and the same thing has long since been observed in women that have been deprived of the ovaries, or in whom these organs are diseased or imperfectly developed. Similar phenomena have been noticed in animals, after the removal of the spleen; though the obesity, in these cases, is generally only temporary, the body gradually returning to its former weight and sparseness. Whether the same changes have ever been witnessed in the human subject, as the result of the extirpation of this organ, I am not prepared to say, as there are no data from which to judge. In birds, considerable accumulations of fat sometimes occur in a very short time. Thus, when the ground is loaded with insects and other nutritious substances, robins and thrushes will occasionally fatten to such an extent, in the course of twenty-four hours, as to be almost unable to get out of the way of the sportman.

*Partial hypertrophy* of this texture is well exemplified in *adipous tumors*. (Fig. 51.) Generally developed under the skin, these tumors not unfrequently occur within the abdominal cavity, in connection with the peritonæum. Their size, though commonly small, is sometimes enormous. Sir Astley Cooper gives an account of one that weighed nearly thirty-eight pounds; and in a recent French journal are recorded the particulars of another that weighed still more. In their shape, these tumors are usually somewhat globular, but as their bulk augments they are apt to become elongated, and to assume a pyriform, gourd-like, or pediculated configuration. Their surface is

Fig. 51.



irregularly lobulated, and they are composed of various sized masses, of a rounded, or ovoidal shape, in all respects similar to those of the adipous tissue in the normal state. They are surrounded by a thin but firm capsule of cellular substance; and their supply of blood is by no means so liberal as might be supposed from their size, and the rapidity of their growth. These tumors sometimes occur in considerable numbers in the same individual. Dagorn, a French physician, mentions an instance in which there were eight, several of them of prodigious size, in different regions of the body. In a gentleman, thirty-eight years of age, who attended our lectures last winter, I counted upwards of two hundred, from the volume of a small pea, up to that of a large marble; they have a doughy, inelastic feel, and are nearly all of a globular shape. They are seated principally on the fore-arms, the inside of the thighs, the loin, abdomen, and pectoral muscles, the latter of which are literally covered with them. None exist on the head, neck, and upper part of the back. They were first noticed about sixteen years ago; the general health is good, and no cause can be assigned for their occurrence. During two severe attacks of acute disease, attended with great emaciation, many of them entirely disappeared. To ascertain the true character of these tumors, I was permitted to remove one, about the size of a filbert, and found it to be entirely composed of fatty matter.

The adipous tumour occasionally, though rarely, inflames and suppurates. The matter is of a thin, sanious character, and mixed with globules of fat. It is seldom that it is collected in a distinct abscess. Abernethy\* has seen osseous matter deposited within the substance of an adipous tumor, and a specimen of a similar kind is contained in the museum of the institute.

In abdominal obesity, the encumbered organs are often literally buried in beds of fat. The tumors are generally more pediculated than those which are developed under the skin, and they may grow either on the omentum, from the epiploic appendages, or beneath the peritonæum, giving that projecting rotundity to the abdomen which is vulgarly distinguished by the name of "pot-belly," and which is so well described by Prince Henry, in his address to Falstaff, as "a huge hill of flesh," "a globe of sinful continents."

Large quantities of fat occasionally envelope the kidney. In a specimen which I took from an old man a few years ago, the mass amounted to three pounds; and Dr. Horner refers to one, removed from a bullock, which filled a common-sized wash-tub.

In the chest large masses of fat sometimes surround the pericardium, and, by compressing the heart and great vessels, induce palpitation, and even fatal syncope. Of this, an interesting case is to be found in the admirable treatise of Senac.

*Atrophy* of the adipous tissue, which is far more common than its preternatural accumulation, may arise from one or other of the following causes: defective or unwholesome diet; organic lesions of the lungs, heart, stomach, or bowels; protracted abstinence, as in fasting, sickness, and the periodical sleep of hibernating animals; excessive loss of blood; immoderate indulgence in ardent spirits; long watching; exposure to intense heat; severe study, and great bodily fatigue. The latter is well exemplified in the case of grooms, and in persons who make long journeys on horseback. Captain Riley, of Ohio, who was shipwrecked on the coast of Africa, and captured by the natives, was reduced from two hundred and forty to ninety-two pounds, from excessive exercise, partly on an old camel, partly on foot, across the sandy

\* Surgical Works, vol. ii., p. 300.

desert. There seems to be sometimes a great diminution of this substance without our being able to assign any satisfactory cause; as, for example, in the case of the celebrated Calvin Edson, who, although apparently in good health, was literally nothing but skin and bone, his entire weight not exceeding fifty-eight pounds.

Men of anxious mind and fretful temper seldom get fat. With what justice does Shakspeare, in one of his most magnificent plays, make Cæsar say —

“ Let me have men about me that are fat;  
Sleek-headed men, and such as sleep o’ nights.  
Yond’ Cassius has a lean and hungry look:  
He thinks too much: such men are dangerous.”\*

The removal of the fat, by whatever cause induced, is probably effected by the conjoined agency of the veins and lymphatics; but upon this subject physiologists are by no means agreed, some ascribing it exclusively to the former, others to the latter, of these vessels. It would be interesting to know in what form this substance is absorbed, whether as oily matter, or after undergoing decomposition. Facts are not wanting in support of both these views; but it must be confessed, that, whilst the one is plausible, the other, namely, the last, is infinitely most in accordance with the laws and operations of the living system. The adipous vesicles, in this affection, diminish in size; and, as their walls are brought in apposition, an erroneous opinion has hence arisen, that they are sometimes entirely obliterated.

The adipous tissue is occasionally the seat of *melanosis*, which is either disseminated in minute inky spots, or deposited in small, spherical tubercles, of a concrete or semi-fluid consistence. Most commonly it occurs in the fat of the orbit, the anus and rectum, in the mesentery and omentum, and around the kidneys. It has also been noticed in the subcutaneous adeps, but much less frequently than in the other situations.

*Fatty transformations* are not unfrequently met with. How they are produced, the present state of our knowledge does not enable us to explain. It is not improbable, however, I think, that they are partly, if not entirely, the result of a tardy inflammatory action, causing a perversion of the nutritive function. These changes, which have hitherto been noticed chiefly in the heart, liver, mammæ, and voluntary muscles, will be described in their appropriate places.

## CHAPTER IV.

### OF THE MUSCULAR SYSTEM.

#### SECTION I.

##### OF THE MUSCLES.

- I. *The Muscles*. — Different Classes. — Structure. — Color and Consistence. — Chemical Analysis. — Sensibility. — Reunite when divided. — Inflammation. — Suppuration. — Mortification. — Chronic Irritation. — Softening. — Induration. — Ossification. — Fibrous and Fatty Transformations. — Heterologous Deposits. — Hypertrophy. — Atrophy. — Parasitic Animals. — Sanguineous Effusions. — II. *The Tendons*. — Appearance and Organization. — Reunite when divided. — Inflammation. — Ossification. — Atrophy. — Diseases of the Sheaths of the Tendons. — III. *The Aponeuroses*. — Structure. — Acute and Chronic Inflammation. — IV. *The Synovial Bursæ*. — Situation and Structure. — Are liable to Disease. — Fibro-cartilaginous Concretions. — Hypertrophy. — Hydatoid Bodies.

ALTHOUGH it is my design, in the present chapter, to speak only of the lesions

\* Julius Cæsar, act i., scene 2.



of the voluntary muscles, yet this appears to be the proper place for making some remarks on the minute structure of the system generally of which they are a part.

The muscles, constituting what is familiarly called the flesh, may be divided, in reference to their functions, into three great classes, the voluntary, involuntary, and mixed. These differ considerably from each other, not only as regards the special impressions which they require to call them into action, but likewise in respect to their physical properties, and the arrangement of their fibres, together with several minor points which it is unnecessary to dwell upon in a treatise of this kind.

The *muscles of volition* embrace those of the trunk, head and limbs, of the tongue, the soft palate, the larynx and pharynx; and, as their name implies, they are strictly under the control of the will. They are supplied by the spinal nerves, on the division of which their action is paralyzed, and they consist each of a body and two extremities, which, in most instances, are tendinous or aponeurotic. The number of voluntary muscles has been variously estimated, but may be stated at about four hundred and fifty. They are of a florid red color, and their size, as well as shape, varies in different regions of the body, the principal bulk of which they form.

The *involuntary muscles* comprehend the fleshy layers of the alimentary tube, from the cardiac extremity of the stomach to the anus, together with those of the heart and urinary bladder. They are in general of a much paler color than the preceding class, and their fibres are spread out so as to form tunics to the hollow viscera; the cavities of which they diminish by their action, and thus serve to propel their contents. No tendons are appended to these muscles, excepting in the case of the heart. They are supplied by the branches of the great sympathetic; and they are consequently enabled to carry on their operations without a conscious effort of the will. Like the preceding class, they have their alternate periods of action and repose, and they are the agents of important vital functions which it would have been dangerous to leave under our control.

The *third class* consists of the diaphragm and œsophagus, together with the trapezoid, sterno-mastoid, intercostal, scalenous, and serrated muscles. The office of these bodies is to preside over the function of respiration. In their color and consistence they do not differ from the voluntary muscles; but they are supplied by a distinct system of nerves, namely, the respiratory of Sir Charles Bell; and they are, therefore, as far as their action is concerned, of a *mixed* character, being partly involuntary, yet not wholly withdrawn from the influence of the will. It may be observed that, in certain diseased states of the body, the voluntary muscles become involuntary, and the involuntary voluntary, though the latter circumstance is much less frequent than the former.

All muscles are composed of fibres (Fig. 52), which are themselves resolvable into minute filaments, held together by cellular substance. In many of the larger muscles, *bundles*, *fasciculi*, or *lacerti*, are observable, which vary very much in magnitude and distinctness: thus they are very large in the gluteal and deltoid, in the fleshy columns of the heart, and in the longitudinal bands of the colon. In general, they run parallel to each other, being separated merely by a thin layer of cellular matter; in some situations, they lie so far apart as to appear like so many muscles. By dissection, these bundles can be divided into *fibres*, which are rendered still more conspicuous by boiling, or immersion in alcohol. The form of these fibres, which is nearly the same in all parts, is prismatic, pentagonal, or hexagonal, but never cylindrical; and they appear to extend in a continuous manner from one extremity of the

muscles to the other. This arrangement, we are informed by Prochaska and Bichat, actually obtains even in the longest muscles, as the *gracilis* and *sartorius*.

The *ultimate filament* (Fig. 53) has been carefully examined by a great many distinguished physiologists, but thus far, owing to its excessive tenuity, no very satisfactory information has been elicited. It is thought by some to consist of a series of rounded corpuscles, about the two-thousandth part of an inch in diameter, which are connected by cellular substance, so as to look like a string of pearls or a row of beads. It is pretty generally agreed, however, since the publication of the researches of Hodgkin, Lister, Grainger, and others, that this view is incorrect, the observations of these gentlemen having led them to conclude that the ultimate filament is a peculiar pulpy structure, arranged into threads of extreme minuteness, which are placed close and parallel to each other, and intersected by a great number of the most delicate transverse lines. Similar results were obtained, long ago, by Fontana.\*

Thus formed, the muscles are enclosed, in general, by an aponeurotic sheath, the degree of condensation of which varies in different situations, being very close in some, but slight in others. The connection between this structure and the organ it invests is effected by cellular substance, which is at the same time prolonged inwards, furnishing thus a distinct covering for each fasciculus, for each fibre, and for each ultimate filament, its delicacy becoming greater and greater as it passes from the one to the other, until at length it escapes the naked eye. No aponeurotic sheaths envelope the muscles of organic life: they are interposed, for the most part, between the mucous and serous membranes, and their interstitial cellular texture is not only less abundant, but so short and condensed as to render it difficult to separate the fibres from each other.

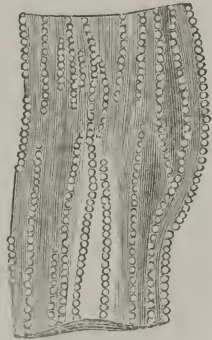
With the exception of the mucous membranes, the skin, and some of the internal viscera, the muscular tissue is more abundantly provided with vessels, absorbents, and nerves, than any other substance of the body. The *arteries*, derived from the neighboring trunks, penetrate the muscles at different points of their periphery, creeping, in the first place, between the larger bundles, then between the smaller, and, finally, between the fibres, their ultimate branches being spent upon the ultimate filament. By means of the microscope, they may be seen ramifying upon the surface of the delicate web of membrane that encloses the muscular pulp, but cannot be traced into it. The *arteries* are generally proportioned to the size of the muscles which they are destined to supply, though, in this respect, there is some diversity. The *accompanying veins* are arranged into two sets; some follow the arteries, the others run superficially on the surface of the muscles. They are large,

Fig. 52.



A portion of muscle enclosed in a fibrous sheath.

Fig. 53.



Ultimate fibres of a muscle highly magnified, showing the string of globules of which they are supposed to consist.

\* *Traité sur le Venin de la Vipère*, t. ii., p. 228.

somewhat flexuous, and may be easily injected from the adjacent trunks, notwithstanding the presence of numerous valves. The *absorbents* are quite abundant: they pursue pretty much the same course as the sanguiferous vessels, but of their mode of origin nothing whatever is known.

The muscles are furnished with *nerves* in proportion, not simply to their volume, but to the variety, frequency, and vivacity of their movements. Hence the reason why some of these bodies that are comparatively small, but which are destined to perform many combinations of actions, are much better provided in this respect than others double their size, but with more simple functions. As a general observation, it may be stated that the muscles of volition receive large and numerous cords; whereas the involuntary, in proportion to their magnitude, are sparingly supplied. The filaments of the nerves usually accompany the sanguiferous vessels, particularly the arteries, to which they are united by cellular substance. They enter the muscles at different points, and at length, after many divisions, they become so minute as to elude all observation. There is, consequently, some uncertainty concerning their ultimate termination, notwithstanding the numerous attempts that have been made to detect it. Before they disappear they part with their cellular envelope, by which circumstance they are rendered soft and transparent, and brought in more immediate contact with the substance in which they end. Sir A. Carlisle states that the ultimate termination is in the cellular web that encloses the muscular pulp. On the other hand, Prevôt and Dumas, who have more recently investigated the subject, maintain that the nervous filaments are not actually spent upon the muscles, but that they return on themselves, and pass either to the trunk which furnishes them, or anastomose with some neighboring ones, either of the same or of a different class.

It has been already stated that the muscles are of a *red complexion*, and, it may now be added, that the intensity of their color varies not only in different persons, but likewise in the same individual in different regions of the body. Thus the voluntary muscles are of a florid color, whilst the fleshy fibres of the intestinal tube and the urinary bladder are always several shades lighter, being in some places, indeed, of a rosaceous grey. Generally, too, these bodies are of a deeper hue in adults than in children and old people, and in those who are constantly engaged in laborious exercise than in such as are indolent, or make but little use of their limbs. Hence it may be assumed, as an axiom, that the florid complexion of the muscles is in direct ratio to the frequency and energy of their employment. The truth of this remark is strikingly exemplified in the muscles of the arm of the blacksmith, as compared with those of the arm of the student; the latter of whom seldom uses his upper extremities, except for the purpose of turning over the leaves of his book, or gratifying the appetites of hunger and thirst. Hence, his muscles are, throughout, soft, pale, and flabby; whereas those of the laborer are hard, firm, and of a deep red color.

The red color of the muscular tissue is altogether accidental, or does not, so to speak, form an essential attribute of this substance. Depending entirely upon the amount of blood which it contains, it can be readily removed by repeated washing, or by maceration in alcohol or alkaline fluids, the fibres remaining, in other respects, unchanged. Hence the color of the muscular tissue, observes an eminent writer, varies with that of the blood, is dark when it is dark, pale when it is pale, and white when it is white.

As the color of the muscular texture varies, so also does its *consistence*. It always contains a much larger amount of moisture in the young than in the old, and is therefore much softer, as well as more pliant and lacerable. Ex-



ercise, as we have just seen, exerts great influence over the consistence of the muscular tissue; and it has long been a matter of observation that there are some subjects in whom it is naturally more soft and juicy than in others. Its cohesive powers are very feeble, and it is wholly devoid of elasticity. On the other hand, it is highly flexible and extensible.

The *analysis* of the muscular texture shows it to be composed of fibrin, albumen, gelatin, osmazome, leucine, free lactic acid, and various kinds of salts. The most remarkable circumstance, perhaps, which chemistry has brought to light in this investigation is, that *nitrogen* exists in a larger proportion in the flesh of old than that of young subjects, and in warm blooded animals than in reptiles and fishes. The quantity of gelatine and albumen is in an inverse ratio in the different periods of life, the former predominating in infancy, but entirely disappearing as we advance in years. It is difficult to say whether the gelatine is to be regarded as proper to the muscles, or as being derived from the cellular substance which enters into their composition. The latter supposition, on the whole, is perhaps the more correct.

The distinctive attribute of the muscular tissue is *contractility*, or that property by virtue of which it alternately shortens and elongates its fibres. The chief purpose of this function is to enable us to carry into effect our various resolutions and designs, or, in other words, the mandates of the will. Three conditions are necessary to the successful execution of this function: 1, a sound state of the muscle; 2, a free and uninterrupted nervous communication; 3, a healthy state of the cerebro-spinal axis. For the production of the involuntary movements, only two conditions are required, namely, a sound state of the fleshy fibres, and the action of an appropriate stimulant. Thus, the blood is the proper and accustomed stimulant of the heart, the urine of the bladder, the food of the stomach, the bile and fecal matter of the intestinal tube.

Finally, the *sensibility* of the muscles, notwithstanding their great nervous endowments, is rather obscure, and like that of all other organs, of a peculiar character. When these structures are subjected to severe exercise, a feeling of lassitude is experienced, often amounting to considerable uneasiness. The distressing sensations in the back and limbs of patients laboring under bilious and intermittent fevers, as well as in some other diseases, are doubtless seated in the muscular texture, instead of the bones, to which they are usually referred by the vulgar. In amputations, the division of the muscles is never attended with the same degree of pain that is felt in cutting through the skin. Yet, although the organs in question enjoy little sensibility in the healthy state, the suffering from them, when inflamed, is sometimes truly exquisite, and almost intolerable.

The voluntary muscles when divided, *unite* by adhesive inflammation, with nearly the same facility as the cutaneous and cellular textures, the period required for the reparation varying according to the extent of the injury and the nature of the constitution. If the edges of the wound be allowed to remain apart, the restoration is effected through the medium of granulations, the growth of which is often rapid and luxuriant. As the healing advances, these bodies contract in volume, and are ultimately converted, by a modelling process, into real muscular tissue, or, at all events, into a substance so closely resembling it as to render it difficult to distinguish them from each other. I cannot understand upon what grounds the partial regeneration of the muscular tissue has been denied by some anatomists. That the bond of union is occasionally of a fibrous, ligamentous, or even cartilaginous character, as is contended by these writers, cannot be doubted; but that such is not the course

which nature generally pursues, even in old persons, the observations of every one must fully convince him. Is it more difficult to conceive of the partial reproduction of a muscle than of a bone? Certainly not, especially when it is remembered how much more delicately the one is organized than the other; or, what is the same thing, how much more liberally it is supplied both with vessels and nerves. Yet, notwithstanding, how often does it happen that some of the largest pieces of the skeleton are almost wholly regenerated when destroyed by necrosis. I do not contend that a muscle, similarly affected, is ever completely reproduced; for, upon this subject, I have no personal experience: I should imagine, however, the circumstance to be within the range of possibility: but that it is extremely rare is sufficiently evident from the few cases of it which are on record.

The principal lesions of the voluntary muscles are inflammation, change of consistence, ossification, atrophy, and their conversion into a substance resembling fat.

*Inflammation* of the muscles is by no means so common as in some of the other textures. It is not improbable, I think, that it sometimes commences in their own substance; much more frequently, however, it is communicated to them from the contiguous parts, as the intervening cellular structure and their aponeurotic coverings. The disease here, as elsewhere, may be acute, as when it is caused by wounds or external injury, or chronic, as when it is associated with gout and rheumatism. In either case, it is generally limited to particular muscles; though, in a few rare instances, it affects a whole group of them, either simultaneously or successively. As comparatively few opportunities have occurred for studying this lesion, it is not surprising that a good account of its anatomical characters should still be a desideratum.

The initial step in the acute form of the disease, as well, perhaps, as in the chronic, consists in an engorged state of the vessels of the connecting cellular texture, which, in consequence, loses its natural whiteness, and assumes a faint red complexion. The fleshy fibres are at the same time increased in density, though as yet they have experienced no change of color. Gradually, however, their vascularity is augmented, the affected part becomes rigid, and their contractile power is so much impaired that motion is not only difficult but painful, the muscle, the subject of the disease, being the seat of constant spasmodic actions.

At a more advanced period, when the disease has reached a higher grade of intensity, the connecting cellular tissue is swollen, and infiltrated with serosity, intermixed with globules and shreds of lymph. The muscular fibres are of a deep mahogany hue, soft, flaccid, easily torn, and scarcely distinguishable from the surrounding parts. The discoloration, although sometimes uniform, and diffused over a large extent of surface, more commonly occurs in irregular patches, with intervals of sound substance. In violent cases, it is not unusual to find small ecchymoses, caused by the rupture of some of the capillary vessels. The muscle, at this advanced stage, is totally changed in its character, and there is generally more or less effusion of serum, lymph, and blood, between it and the circumjacent structures, with inflammatory appearances of its aponeurotic sheath. The ordinary stimulants, as might be supposed, no longer exert their accustomed influence. The fleshy fibres remain rigidly fixed, in spite even of the division of the main nerve. Galvanism also fails in producing the usual phenomena.

It is seldom that inflammation, whether acute or chronic, passes into *suppuration*. This rare occurrence is most frequently witnessed in neglected erysipelas of the extremities; but the most perfect example of it is seen in what is called

psoas abscess; in which the psoas and iliac muscles sometimes entirely disappear, being converted into a large purulent sac, extending from the first lumbar vertebra to the groin. The pus, which is of the same nature as in other parts of the body, is deposited originally in small disseminated globules, which give the affected part a singularly speckled appearance.

Not less rare is *mortification* of the external muscles. This termination has hitherto been observed chiefly, if not wholly, in erysipelatous and carbuncular inflammation, in old worn-out subjects. The lesion is easily recognized by the altered color of the fleshy fibres, which are usually of a dark, cineritious aspect, by their softness and lacerability, and by their gangrenous odor. The sloughs are detached in ragged shreds, bathed by a thin, dirty, sanious, and offensive fluid. The injured muscle is never entirely regenerated; and the sphacelus, if extensive, generally proves fatal.

In *chronic inflammation*, the muscular tissue loses its florid complexion, and assumes a pale yellowish appearance, not unlike that of an autumnal leaf. Its consistence is also increased; and the fleshy fibres, which are often very much thickened, are so firmly glued to each other as to render it difficult to separate them. This form of myositis, as before intimated, occasionally terminates in suppuration. Another effect, which is still more rare, is *ulceration*. This is sometimes observed in phagedenic sores of the leg, extending in succession through the skin, cellular substance, aponeurosis, and, finally, the muscular texture. The most remarkable circumstance about these erosions is the disappearance of the fleshy fibres, or their conversion into fibrous substance. When the constitution is good, the restorative process generally goes on kindly, and the ulcer is soon filled with healthy granulations.

The muscles are occasionally deprived of their natural *consistence*. The diminution of cohesion to which this alteration gives rise is generally limited to particular muscles, or even to particular portions of them. The exciting causes of this affection are still involved in considerable obscurity; but that it frequently depends upon irritation and loss of nervous power, does not admit, it seems to me, of any reasonable doubt. In proof of the justness of this view, it may be added, that the lesion we are now contemplating is usually connected with inflammatory appearances of the collateral tissues, or with general or partial paralysis. De Haen relates a remarkable example of softening of the muscles of an individual who was seized with palsy of the superior extremities, after an attack of painters' colic; and similar instances are recorded by Barthez and other writers. In both the cases mentioned by these authors, the affected structures were of a soft, pulpy consistence, but gradually regained their normal character as the enteric disease subsided. A flaccid condition of the muscular system often coexists with what is termed the tubercular cachexy, and with a watery and impoverished state of the blood. By whatever cause the lesion is induced, the fleshy fibres are unusually pale, bordering on a light fawn tint, flabby, and easily lacerated, the slightest pressure being sufficient to convert them into a soft, pulpy mass.

The reverse of the condition now described is sometimes observed, namely, a considerable degree of *induration* of the muscular tissue. This lesion, which appears to arise from the effusion of plastic lymph into the interstitial cellular substance, is frequently seen in the neighborhood of fractured bones, around scirrhus tumors, and in the legs of persons affected with elephantiasis, gout, and rheumatism. Under the influence of these causes, the muscular fibres are rendered hard and firm, and, in some instances, almost cartilaginous. The color, in the early stage, is simply brown: subsequently it acquires a pale reddish tint, and at a still later period the part exhibits a greyish leaden aspect, with here and there a spot retaining a portion of its natural complexion.



It has been doubted by high authority, whether the muscular texture is ever the seat of *ossification*. I am myself inclined to think, with Andral and others, that the primitive locality of the deposition is the interstitial cellular substance, from whence it gradually extends to the fleshy fibres, blanching and extenuating them, or even wholly destroying them by absorption. This degeneration, though commonly confined to individual muscles, as those of the loins, shoulder, and calf of the leg, occasionally affects a great number of them. A striking example, in which the whole muscular system exhibited the ossific diathesis, is recorded by Dr. Henry, of England.\* The patient was a laborer, nineteen years of age, and the disease, as is usual in such cases, was connected with exostotic enlargement of the bones. A painful swelling was first perceived at the right wrist, which, as it increased, gradually involved all the muscles of the fore-arm, and converted them into one solid mass as high as the elbow. The left limb was attacked in a similar manner; then the right leg, from the ankle to the knee, and finally the shoulders and hands, rendering the superior extremities completely stiff and useless.

A case, in which most of the muscles of the back, shoulder, and chest were ossified, is related in the thirteenth volume of the American Journal of the Medical Sciences, by David L. Rogers, of New York. The subject was a boy aged thirteen years, whose health had been always good until about six months before his death. The sterno-cleido-mastoid, great and small pectoral, trapezius, rhomboid, subscapular, broad and long dorsal, together with the muscles about the great trochanter, were all transformed, either partially or wholly, into bony layers. The scapula was fixed to the ribs and studded with bony excrescences. The great and small pectoral muscles were united into one, and attached to the ribs by osseous matter. The tendinous parts of the muscles were free from disease, and there was no ossification of the vascular system. In several situations spicula of bone, from one to two inches long, projected from the affected muscles. The mesenteric glands were increased in size, and a large abscess existed on each side of the chest. The abdominal and thoracic organs appeared to be healthy.

Ossification of particular muscles is sometimes witnessed as an effect of long-continued pressure. In recruits, the deltoid and pectoral muscles of the left side occasionally experience this transformation in a considerable degree, from the irritation produced by carrying the musket. A small, red, painful swelling is formed, which, if neglected, terminates in a mass of bone, from four to seven inches in length, and from two drachms to upwards of an ounce in weight.

This ossific tendency is occasionally exhibited in early life, and constitutes a very serious disease, in which not only the muscles, but also the ligaments and tendons are implicated.

In gouty and rickety subjects, whitish stone-like concretions are occasionally found in the muscles: they are usually of a spherical shape, with a volume seldom exceeding that of a pea, and consist principally of phosphate and carbonate of lime, cemented together by a minute quantity of animal matter.

The muscular tissue is occasionally transformed into the *fibrous*. The degeneration sometimes involves whole muscles, which, when the change is completed, scarcely retain a single vestige of their original features, save their shape, and even this is often materially altered. The deltoid and sterno-mastoid appear to be more frequently affected in this way than any other parts of the muscular system. The cause of this transformation admits of easy explanation. Whenever a muscle is placed in a state of total inactivity, it

\* London Philosophical Transactions, vol. xxi., p. 89.

experiences a modification of nutrition, by which, without any appreciable irritation, it gradually loses its fleshy character, and is converted into a fibrous substance, the economy making an effort, so to speak, to get rid of it, as a structure that is of no further use. This view of the case derives confirmation from what occurs in the inferior animals. In some species of quadrupeds, parts that are distinctly muscular in early life, are subsequently, by some change in the function of nutrition, transformed into another texture, better adapted to the wants of the system than one which is simply contractile.

Another lesion to which the muscles, in common with several other organs, are liable, is the *fatty degeneration*. In this affection the muscles generally retain their original form and volume, though in some instances they are partially shrivelled and disfigured. They are of a pale straw color, or even entirely white, unctuous to the touch, and rather diminished than increased in consistence. Notwithstanding all this, however, the linear arrangement of their fibres is not only recognizable by the eye, but can be easily traced with the scalpel. On pressure, a clear oily fluid oozes out, which greases the finger, or whatever else is brought in contact with it, and is of an unusually inflammable nature. According to the analysis of Cruveilhier,\* muscular tissue, which has undergone the adipous degeneration, consists of an oily liquid, probably elaine, gelatine, adipocire, solid fat, and a substance resembling boiled flesh. These materials, the quantity of which is variable, are not deposited between the muscular filaments, as has been conjectured by some, but form actually a part of their component principles. It is worthy of remark, however, that the interstitial cellular element is always considerably altered, being of a whitish color, very soft, and lacerable.

The fatty transformation is most marked in the muscles of the loins, hip, thigh, and leg of old persons affected with paralysis. It is likewise observed, in some rare instances, in the muscles around unreduced luxations, large exostoses, and old deep-seated ulcers. When the change is complete and extensive, it occasionally involves the corresponding tendons and aponeuroses, which, in consequence, lose their polished, satin-like lustre.

It rarely happens that we have an opportunity of observing *tubercles* in the muscular tissue. When present, they are generally connected with a strumous diathesis, and coexist in other parts of the body. Otto states that he has several times seen tubercles in the muscles of the neck and thigh of scrofulous monkeys; Andral has noticed similar bodies in the muscles of the hog. In the case to which the latter writer refers, they occurred in association with small transparent hydatids, evidently of the cysticercic kind.

Not less uncommon is *melanosis*. This deposit is sometimes seen in the form of an infiltration, which imparts its peculiar stain to the muscular fibres, converting them into a soft, pulpy substance, in which it is impossible to recognize the slightest trace of the primitive structure. Occasionally, again, the black matter is encysted, presenting an irregularly spherical mass, of pretty firm consistence, the volume of which varies from that of a pea to that of a fetal head. This morbid formation is sometimes directly chargeable to external injury; at other times, it takes place without any assignable cause. It usually betrays a malignant character, proceeding, if allowed to remain, to ulceration, and returning, sooner or later, when extirpated.

*Scirrhus* and *encephaloid* are also extremely infrequent. Indeed, so seldom do these heteroclite formations occur in the muscular system, that it has hitherto fallen to the lot of few pathological anatomists to observe them. The diagnosis of their tumors is often obscure, and difficult of determination. Scirrhus, it should be remembered, generally makes its appearance in old persons, whereas

\* Essai sur l'Anatomie Pathologique, t. i., p. 189.

encephaloid occurs at all periods of life, in the young as well as in the old. Much assistance may also be derived from the form and consistence of the morbid deposit. A scirrhus tumor is pretty regularly circumscribed, hard, and almost incompressible; an encephaloid one, on the contrary, is generally lobulated, firmer in some parts than in others, doughy, and somewhat inelastic; the growth of the one, moreover, is usually very slow, and attended with darting, lancinating pain; that of the other is almost always rapid, unaccompanied with much local uneasiness, and remarkable for its great bulk. When ulceration takes place, the scirrhus tumor gives vent to a thin, ichorous, irritating discharge; the sore is deep, and the edges hard and inverted; the encephaloid swelling, on the other hand, throws out a soft, fungous excrescence, and is the seat of frequent hemorrhages.

On the whole, it appears extremely doubtful, whether any of the heterologous formations are ever seated, in reality, in the muscular substance. In all probability they are originally developed in the interstitial cellular tissue, from whence, as they augment in volume, they encroach upon the fleshy fibres, which they displace, alter, or destroy. On this point, however, I am not prepared to deliver a positive opinion; nor do I know any one that is. Professor Warren, of Boston, who has written one of the most excellent treatises on tumors extant, has given us no information on the subject; and I am fully persuaded, from all that can be gathered, that further observation is necessary before we can arrive at any satisfactory conclusion concerning it.

*Hypertrophy* of the voluntary muscles is extremely infrequent, and has hitherto been noticed chiefly in the tongue, where, as will be shown hereafter, it is occasionally congenital. As occurring from the influence of inordinate exercise, and the unusual influx of blood, the best example is that which takes place in the muscles of the arm of the blacksmith, and in the leg of the rope dancer. Muscles that have experienced this change, whether it be the result of accident, or purely physiological, are of a deep red color, firm, tough, and comparatively little compressible, with a bulk greatly exceeding what is observed in the normal state.

A more common affection is *atrophy*, or unnatural diminution of volume. It may arise either from general disease, such as phthisis, carcinoma, or dropsy, or from local difficulty, as inflammation, ordinary palsy, or defective nutrition. Indeed, whatever has a tendency to impair the function of innervation, retard the circulation of the blood, or produce permanent inactivity, may be considered as so many causes which are followed, sooner or later, by atrophy of the voluntary muscles. Hence this lesion is generally associated with palsy, whether proceeding indirectly from disease of the cerebro-spinal axis, or directly from injury of the nerves supplying the affected part. The muscles around luxated joints, especially those of the hip and shoulder, are often atrophied, simply, it would appear, from want of exercise.

The extent to which the wasting of the muscles proceeds is various. Frequently they are reduced to mere membranous bands, pale, flaccid, and almost devoid of irritability; in some rare instances, their fibres are entirely absorbed, a dense cellular substance being all that is left in their place. In persons dying of protracted diseases, I have repeatedly observed a dark bluish color in particular muscles, especially those of the abdomen, accompanied with remarkable flaccidity and facility of laceration. These changes are more common in negroes; and, from having often noticed them within a few hours after death, I am disposed to think that they are not altogether cadaveric. Dropsical and consumptive subjects, more frequently than any other, present these appearances.

The voluntary muscles are occasionally infested by parasitic animals, the principal of which are the cysticercic hydatid, and the spiral trichina. The



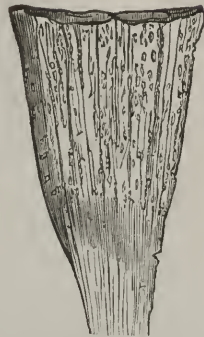
former are seldom seen in the human subject, but are very common in the swine, sheep, and other quadrupeds, in which, particularly in the first, they often exist in immense numbers, rendering the flesh completely unfit for use. The *spiral trichina* (Figs. 54, 55, 56), which has been recently discovered by Mr. Richard Owen, a distinguished English naturalist, is a very delicate, minute, coiled-up, entozoon, about the twenty-fourth of a line in length, and the seven-hundredth part of an inch in diameter. It is of a cylindrical shape, and terminates obtusely at both extremities, which are of unequal size, the larger being furnished with a transverse linear orifice, which evidently answers the purpose of a mouth.

The alimentary canal, as described by Dr. Farre,\* is bounded by two slightly irregular lines running parallel to each other, for the distance of rather more than one-fifth of the length of the body, where they terminate in a transverse ridge, presenting a minute concavity towards the large extremity. From this point on, the canal exhibits a sacculated arrangement, the little dilatation appearing as if bound down by a line extending along the surface of the tube in the direction of its axis. This sacculated appearance is gradually lost towards the smaller end, where the part assumes a zigzag or spiral course, and terminates in a small slit, which Mr. Owen regards as the anus. No nervous system has been discovered. In the female Dr. Farre has pointed out a collection of ten or twelve granules, about one-fifth of the length of the body from the blunt extremity, which he considers as the ovarium.

It is a singular fact that this worm is always enclosed by a distinct cyst, which is the reason, probably, why it so long escaped the observation of anatomists; since it appears, from the researches of Owen, Knox, Hodgkin, and others, that its occurrence is rather frequent than otherwise. This cyst, which is supposed by some to be merely condensed cellular tissue, is formed out of the plastic lymph of the blood, and is scarcely one-fortieth by one-hundredth of an inch in diameter. It is of a whitish appearance, and of an oblong shape, with one extremity so contracted as to form a short, imperfect neck.

Amongst a collection of trichinas, it is by no means uncommon to find some which have lost their vitality or been entirely removed by absorption. In such cases, the enclosing cyst is usually collapsed, more or less opaque, or even ossified, like that of a dead hydatid. It is probable that these parasitic animals enjoy but a very brief existence, though, upon this point, we have no satisfactory information. The length of time that they retain their vitality after removal from the body of the patient in which they are found, is variable. Mr. Owen mentions the fact of life having been discovered two weeks after death. Generally there is only one animal in each cyst, but Dr. Bowditch† has seen two, and Dr. Farre‡ as many as three. This,

Fig. 54.



Cysts of the spiral trichina in situ, natural size.

Fig. 55.



Separate cyst, containing the trichina magnified.

Fig. 56.



The animal magnified; a, head; b, tail; c, body.

\* Library of Practical Medicine, by Dr. Tweedie, Amer. edit.

† Boston Med. and Surg. Jour., vol. xxiv., p. 117.

‡ Library of Practical Medicine, arranged by Dr. Tweedie, Amer. edit.

however, is extremely rare. The enclosing cyst lies parallel to the fleshy fibres, in the connecting cellular tissue of which it is developed. The trichina is almost wholly confined to the muscles of voluntary motion, together with the tendinous structures immediately connected with them. It has also been met with in the little muscles of the ossicles of the ear, but it has never been seen in the substance of the heart or in the fleshy fibres of the alimentary canal. Their number is sometimes immense. Dr. Bowditch states that he has counted upwards of fifty in a superficies of a quarter of an inch square, and he supposes that the muscular system of a person of moderate stature might contain as many as 7,680,000. The development of these minute bodies seems to be uninfluenced by age, sex, constitution, or any particular form of disease, though they have hitherto been most frequently observed in chronic organic affections.\* In one instance, they were found in a man who was killed apparently in perfect health. Of their mode of origin, growth, and nourishment, nothing whatever is known.

Under the name of *muscular apoplexy*, Cruveilhier has recently described a very singular disease, which, notwithstanding its great infrequency, is deserving of brief notice. The lesion appears to be most common in scorbutic subjects, or in persons of a weak and lax fibre, with a thin and watery state of the blood. It has likewise been noticed in people affected with intermittent fever, delirium tremens, and phlegmonous erysipelas. No muscles, not even the heart, are exempt from this effusion; but, according to the author above quoted, the straight muscles of the abdomen are more frequently and extensively affected than any other. The number of apoplectic depôts is extremely variable. In some instances there are only a few, whilst in others there are several dozens. They are at first of a dark color and soft consistence, but they gradually become lighter and more solid, resembling, in these respects, the apoplectic depôts of the cerebral tissue. In volume, they range between a pea and a hen's egg. The muscular texture immediately around these collections is more or less lacerated, and infiltrated with blood.

Cruveilhier† thinks he has conclusively proved that these sanguineous effusions are dependent upon phlebitis. By injecting ink, diluted with water, into the femoral veins of dogs, he found, in a few days, all the muscles of the corresponding limb studded with clots of blood, which had evidently been deposited in the midst of the lacerated fibres. In such of the animals as survived from four to eight weeks, cicatrices were discovered, entirely similar to those that are sometimes seen in the brain. These experiments require to be repeated and modified before we can venture to deduce from them any positive conclusions.

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## SECTION II.

### OF THE TENDONS.

The appearance of the *tendons* is familiar to every one. They are white, elongated bodies, which serve, on the one hand, to receive the muscular fibres, and, on the other, to connect them with the bones, ligaments, and cartilages. In regard to their shape, some are rope-like, others membranous; and,

\* London Cyclopædia of Anatomy and Physiology, vol. i., p. 115.

† Dict. de Médecine et de Chirurgie Pratique, t. iii., p. 288.

in most situations, they are enclosed by strong sheaths, the inner surface of which is lined by a synovial structure, to facilitate their gliding movements. The connection between the tendons and muscles is so intimate that it is impossible to sever it, except by protracted boiling and maceration. It was owing to this circumstance that some of the older anatomists were induced to assert the real identity of these organs; the only difference depending, as they alleged, upon the greater density of the one over that of the other.

The tendons consist of white, glistening fibres, the tenacity of which exceeds that of almost every other animal tissue: they lie close and parallel to each other, and are tied together by condensed cellular substance. No nerves have been traced into the tendons, and in the normal state they are perfectly insensible. Their vessels, although small, are perfectly injectable, notwithstanding the reverse is usually asserted by anatomists. I was shown, a few years ago, a beautiful specimen of the tendo-achillis of a child, in the cabinet of Dr. Mott, of New York, the arteries of which were so completely filled with size, colored with vermilion, that the whole exhibited a florid appearance. A similar preparation is contained in my own collection. Immersion in spirits of turpentine, by rendering the tendinous structure more transparent, shows the distribution of the vessels to great advantage.

The basis of the tendinous texture is gelatine, which is readily extracted by boiling. It is destitute of elasticity, as well as of extensibility, and is therefore well calculated to transmit to the bones the action of the muscles; in the accomplishment of which purpose — the principal one it has to fulfil — its operation appears to be wholly mechanical.

The tendons, as before stated, are embraced and fixed in their place by fibrous *sheaths*, the internal surface of which is lined by a synovial membrane, and constantly lubricated by a sort of oily halitus. Externally they are rough, and united to the surrounding parts by lax, cellular substance. These envelopes are very strong and thick, especially on the dorsal surface of the leg and fore-arm: some of them contain several tendons, and they are composed of aponeurotic fibres, closely interwoven with each other. Their organization is similar to that of the tendons.

Professor Mayo\* has made a number of experiments, which show that the extremities of tendons which have been divided readily *re-unite* through the intervention of a firm, tough substance, which gradually assumes all the properties of the original texture. During the first few days, this matter is very soft, and of a red color, from the admixture of the blood poured out in the operation. By and by, it augments in density, becomes slightly elastic, and adheres more or less tenaciously, not only to the cut ends of the tendon, but likewise to its fibrous sheath, which is discolored for some distance from the wound. Towards the close of the third week, the extravasated blood is entirely absorbed, and the new substance, which is now of a pale greyish complexion, is found diminished in thickness, but increased in firmness, and inseparably coherent with the original structure, to the properties of which it ultimately assimilates itself.

When these bodies are destroyed by gangrene, it is probable that they are never entirely regenerated. I am not ignorant of the remarkable example related by Dr. Baronio, an Italian physician, of the reproduction of the whole tendo-achillis: but such instances are extremely rare, and, at best, of very doubtful character.

From what is known concerning the organization of the tendons, it might be inferred that they are not very prone to inflammation; and such, indeed, experience has shown to be the fact. The disease, in most cases, arises

\* Outlines of Human Physiology, p. 477, fourth edition.



spontaneously from the influence of the syphilitic poison, the operation of mercury, or from the effect of atmospheric vicissitudes. Its march, under these circumstances, is generally of a chronic nature, the most important alterations which it induces being hypertrophy and induration of the affected part. Conjoined with these changes are usually certain morbid appearances of the fibrous sheaths, such as infiltration of its external cellular texture with a greenish jelly-like fluid, thickening and opacity of the lining membrane, and effusion of yellow turbid synovia. Purulent matter is sometimes poured out; and the tendinous structure may be so much altered as to become unfit for its functions.

The process of *acute inflammation* is most distinctly seen in wounds, sprains, and whitloe. The tendon loses its natural polish, and assumes a faint reddish color, from the engorged state of its capillaries. At a more advanced stage, lymph is poured out, either alone, or mixed with serum and blood; in violent cases, suppuration occasionally sets in; but this is rare. When the inflammation has attained its height, the tendon is of a pale ash color, soft, pulpy, and considerably thickened.

Inflammation readily deprives the tendons of their vitality; a circumstance which is not surprising when we consider their feeble and imperfect organization. Whole cords are sometimes destroyed by this disease, and ultimately cast off by ulcerative action; the work of separation, however, is usually very tedious, and resembles a good deal the exfoliation of a necrosed bone. In this state, the tendons lose their pearly lustre, assume a dull greyish aspect, and become thick and doughy; the individual fibres, however, retaining, in some degree, their original consistence. This occurrence most frequently happens in the fingers and palms of the hand in what is called whitloe; one of the most painful and distressing affections to which these textures are liable.

*Ossification* of the tendons is much less common in man than in the inferior animals. Birds are very liable to it; it is also frequently observed in the horse, sheep, goat, and ox. The change is most common in the tendons of the foot in old subjects, where they slide over, and rub upon the bones.

*Atrophy* is likewise very rare, and is only observed in connexion with great wasting of the muscular texture. Inordinate enlargement occurs principally as an effect of chronic inflammation. I am not aware that any of the heterologous deposits ever take place either in the tendons, or in any of the other structures included in the present chapter.

The sheaths of the tendons, like other serous structures, are subject to *dropsical accumulations*. The bags thus formed are generally of an ovoidal shape, and vary in size from that of a pea to that of an apricot. Their contents are usually of a glairy viscid character, like the white of eggs, though, in this respect, there is considerable diversity in different cases. Sometimes, along with the fluid, the sac contains a number of loose bodies, similar to the concretions found in the moveable joints and synovial bursae. They are of a pale yellowish color, tough consistence, shaped like gourd-seeds, and of variable size, from that of a grain of wheat to that of a bean.

This disease constitutes what, in surgical language, is called a *ganglion*. A difference of opinion has existed in regard to the nature of this affection, the question being, whether it is of new formation, or merely a sacculated expansion of the serous lining of the tubercular structure in question. For my own part, I have no hesitation in saying, from what I know respecting this lesion, that the former opinion is entirely gratuitous. The disease occurs most frequently at the wrist, along the extensor tendons. Females are more subject to it than males, especially such as are much engaged in hard manual exercise. It is likewise very common in horses, in which it is known by the name of wind-galls.

## SECTION III.

## OF THE APONEUROSSES.

The aponeuroses are fibrous membranes, which bind down and enclose the muscles, at the same time insulating them from each other. Their arrangement is that of sheaths, which encase the extremities, and thus serve to prevent any displacement of the organs they envelope. Externally they are rough, flocculent, and in contact with cellulo-adipous matter: internally they correspond to the muscles, to which they are loosely united in some places but very firmly in others. Generally speaking, these structures consist of a single layer, the thickness of which is proportionate to the volume and strength of the bodies which they enclose. They are very sparingly supplied with vessels, nerves, and absorbents; and, in the normal state, appear quite insensible.

The aponeuroses, possessing the same organization as the periosteum, dura mater, and pericardium, are liable to the same diseases. *Acute inflammation* is very rare, and observed principally as the result of external violence, whitloes, and anthrax. Gout and rheumatism are supposed to have their seat exclusively in the fibrous envelopes of the extremities, but of the truth of this opinion many physicians still entertain serious doubts. My own idea, which coincides with that of Scudamore, is, that the aponeurotic, ligamentous, tendinous, and bursal textures are all implicated in nearly the same degree, the diseases here referred to sometimes beginning in the one, sometimes in the other, but sooner or later attacking the whole of them. But upon these subjects we stand in need of further and more substantial information.

In *chronic inflammation*, which, by the way, is much more common than the acute form of the disorder, the aponeuroses become thickened, preternaturally hard, and of a pale yellowish color, interspersed with greyish, leaden, or brownish patches. Spicules of bone sometimes sprout from them, which occasionally acquire quite a large size, and exhibit the appearance of so many stalactites. Another effect of chronic irritation, likewise very rare, is extreme attenuation of these membranes, constituting a sort of real atrophy. This result is generally produced by the pressure of a tumor, which, exerting its detrimental influence for some time, by degrees causes the absorption of the aponeurotic fibres. Inflammation of these structures manifests little disposition to pass into suppuration, gangrene, or ulceration; and the heterologous deposits are, I believe, entirely unknown in them.

## SECTION IV.

## OF THE SYNOVIAL BURSSES.

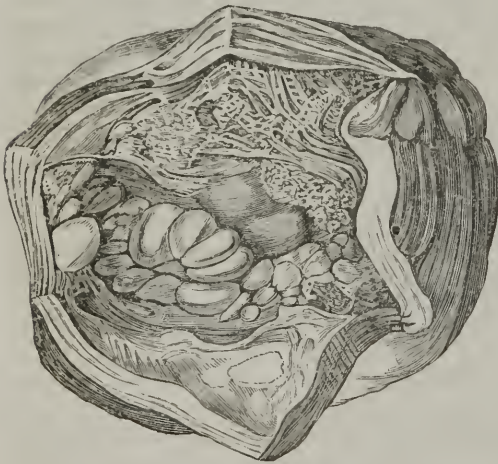
The *synovial bursae* are small, semi-transparent sacs, filled with a thin unctuous fluid, and situated about the joints, especially those of the extremities. For the most part, they lie between the bones and tendons, or between tendon and tendon, or finally between the bones and skin. Nearly one hundred and fifty of these pouches are to be found in different regions of the body. Their structure is perfectly identical with that of the synovia, membranes of the joints, being, like them, resolvable by maceration into cellular substance: they are sparingly supplied with vessels and nerve

possess little sensibility in the sound state, and are constantly lubricated by a thin oily fluid, which thus enables them to facilitate the motions of the parts between which they are situated, and which seems to be their principal office. Thus constituted, the synovial bursæ are liable to inflammation, suppuration, thickening, and cartilaginous degeneration.

One of the earliest effects of acute inflammation is an increase of vascularity,—the redness here, as in the other serous structures, appearing at first in separate lines, which at length coalesce and thus assume an arborescent arrangement. In some instances, the redness has a dotted form, or there are small ecchymoses, caused by the rupture of one or more capillaries. The synovial membrane loses its transparency, and presents an opaque, milky aspect, being as yet little or not at all thickened. When the disease is at its height, the natural secretion is partially suspended, which, however, lasts only for a short time, when it not only augments in quantity, but is likewise changed in quality. Instead of being thin, oily, and transparent, it takes on the appearance of a brownish, turbid serum, mixed with flakes of lymph, pus, or even small clots of blood. The tumor which is thus formed is sometimes as large as a cocoanut, but generally it does not exceed the size of a walnut, an orange, or a goose's egg: in most cases, it is somewhat rounded, elastic, and painful on pressure, the skin covering it being red and hot. The abscess may open externally, or the sac may burst, and the matter be effused into the surrounding cellular tissue. I have, in a few instances, found these tumors filled with a fluid of the color and consistence of currant jelly.

When the disease is *chronic*, the effused fluid is sometimes loaded with loose concretions, of a dense semi-cartilaginous consistence. (Fig. 57.) They are

Fig. 57.



of a light brownish color, and of a flat oval form, not unlike melon-seeds. Their numbers are occasionally quite great, upwards of fifty having been extracted from a single bursa. How are these bodies produced? Sir Benjamin Brodie supposes that they are merely masses of plastic lymph originally poured out in soft, amorphous flakes, which by degrees become firm, and assume a determinate shape by the pressure of the surrounding parts. This is one way of accounting for them; another is to suppose that they originally grow from the inner surface of the sac, from which they are at

length detached by friction, like the little tumors sometimes met with in the movable joints.

Bodies closely resembling *hydatids* are sometimes found in the synovial bursæ. In a case, the particulars of which were detailed a few years ago by Professor Cloquet, of Paris, there were upwards of one hundred and forty of these substances, varying from one to three lines in diameter, nearly transparent, and of a lenticular shape; they were situated in a large pouch between the great trochanter and the tendon of the great gluteal muscle. More recently he has met with them in an accidental cyst, near the insertion of the tricipital muscle of the arm, and also in the sheath of the tendon of the long palmar muscle.



In protracted cases of this disease, the sac is very apt to become *hypertrophied* and indurated. Sir Benjamin Brodie has seen it more than half an inch in thickness, with a small central cavity filled with synovial fluid. In the horse I have repeatedly seen it converted into a hard gristly substance; and the same phenomenon has often been witnessed in the human subject. Cases are recorded, where it is said to have partaken of an osseous character. Not unfrequently the inner surface of the sac exhibits a honeycomb appearance, the shreds of lymph intersecting each other in various directions. In other instances, however, though the inflammation may have persisted for a long time, the membrane retains nearly its primitive structure.

## CHAPTER V.

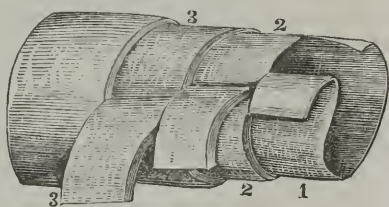
### OF THE ARTERIES.

Their Tunics. — Nutrient Vessels. — Nerves. — Cellular Sheath. — Lesions. — Wounds. — Inflammation. — Suppuration. — Ulceration. — Aneurism. — Contraction. — Hypertrophy. — Morbid Deposits.

THE arteries, distributed through the various organs and textures of the animal fabric, are composed each of three cylindrical coats, differing from each other materially in their structure and functions. The external one, decidedly the most important of the three, is of a white greyish color, and made up of dense cellular substance, the filaments of which, although closely matted together, follow no assignable course. It is highly tenacious, extensible, and elastic, and therefore well qualified to resist violence, and slide out of the way of injury. Its firmness is so great that it is not easily divided by the ligature; and, in cases of disease, it often preserves its integrity long after the other tunics are destroyed, or, at all events, very much altered. In old, corpulent subjects, this membrane is sometimes the seat of a small quantity of adipous matter; but it does not appear to be liable, like the same structure in other regions of the body, to serous infiltration, owing, doubtless, to the peculiar mode of aggregation of its component filaments. (Fig. 58.)

The *middle tunic*, supposed at one time, though erroneously, to be muscular, contains the peculiar tissue which imparts to these tubes their characteristic attributes. It is composed of dense, yellowish, buff-colored fibres, arranged spirally round the caliber of the vessel, none of them forming complete circles, but rather segments, which are joined so as to produce rings. United together by short cellular substance, these fibres are proportionally stronger in the smaller than in the larger trunks, in the latter of which they can be separated into a number of lamellæ, varying in thickness and density, according to the artery in which they are examined. Thus constituted, the middle coat is firm, solid, and elastic, yet withal so brittle that it is readily divided by the ligature. Its thickness exceeds that of the other membranes, and its extensibility is much greater in the longitudinal than in the transverse direction. Viewed in reference to its structure, it may be considered as forming a sort of connecting link between the cellular and yellow fibro-elastic tissues, combining the strength of the

Fig. 58.



Coats of an artery separated from each other. 1, internal membrane; 2, middle tunic; 3, external membrane.

former with the astonishing elasticity of the latter. No fibrin, the proximate element of muscle, has yet been detected in its substance.

The internal tunic, by far the most delicate of the three, is remarkably thin, smooth, and transparent, being designed, apparently, not so much to give strength to the arteries as to furnish their interior with a polished and unctuous surface, to facilitate the movement of the blood. Lining the whole aortic portion of the vascular system, it passes through the left chambers of the heart into the four pulmonary veins, which it supplies in their entire extent, but is not continued into the pulmonary arteries. This membrane, from its great fragility, readily yields under the ligature, and is not susceptible, moreover, of much extension. Its inner surface is smooth, polished, and constantly bedewed by a thin, watery fluid, on which account it is customary to associate it with the serous textures. Although it presents many characters in common with these membranes, it nevertheless differs from them in several important particulars, and may therefore be very properly regarded, I think, as a peculiar structure, unlike any other in the body.

In some of the arteries, the inner tunic is disposed in longitudinal, in others, as in the popliteal, in transverse plait. The latter are always very conspicuous in lacerated wounds, and they are supposed, by Mr. Guthrie, to perform a very important part in the suppression of hemorrhage. No valves are formed by this membrane, except at the mouth of the aorta, where it is arranged into three duplicatures, at the free margin of which is a peculiar fibro-cartilaginous body, styled the corpusele of Aurantius. These valves will be described more particularly in another page.

These different tunics are cemented together by cellular matter, and they are not only liberally supplied with proper nutrient vessels, but likewise with nerves and lymphatics. None of these structures can be traced beyond the subserous cellular tissue; but, that they extend into the internal membrane, is abundantly proved by its capability of undergoing the various processes dependent upon inflammation, to say nothing of the fact of its free surface being the seat of a constant secretion in the normal state. The nutrient vessels can be easily demonstrated by artificial injection, and they are generally very conspicuous in the larger trunks after death, especially in asphyxiated subjects. From their physiological importance, it is obvious that they should be as little disturbed as possible in surgical operations, as any violence done to them must necessarily eventuate in corresponding mischief to the parts which they supply.

The nerves of the arteries are extremely numerous, and, in many of the larger trunks, they may be seen forming a sort of plexus around them, not unlike those which encircle the œsophagus. In the splanchnic cavities they are furnished principally by the great sympathetic, but in the extremities they are entirely derived from the cerebro-spinal axis. The pulmonary arteries, besides receiving some filaments from the sympathetic, are supplied by the par vagum.

Finally, the arteries, in most regions, are enclosed by a loose sheath of cellular substance, which has been described by some as a distinct and separate coat. By this sheath, which performs a most important character in the suppression of hemorrhage, the vessels are connected to the surrounding organs, and enabled to maintain their proper position.

Thus constructed, the arteries are liable to wounds, inflammation, suppuration, ulceration, dilatation, and contraction, hypertrophy, and different morbid deposits.

That wounded arteries possess the power of self-reparation is a fact which was long since proclaimed by Haller, Petit, and other writers of the last century; but the process by which this is effected, or the various steps which precede and accompany it, was first clearly pointed out by Dr. Jones, of England, about thirty-five years ago. Convinced that a question of so momentous

a character could be determined only by carefully interrogating nature, he instituted a series of the most laborious experiments upon the inferior animals, such as the horse and dog, from which he deduced the conclusion, since so abundantly confirmed by the researches of other physiologists, that the immediate effect of the division of an artery is an impetuous flow of blood, attended by a forcible retraction of the vessel within its sheath, and a slight annular contraction of its extremity. The canal of the sheath is now closed by the formation of a coagulum, blood being at the same time effused into the surrounding cellular substance. The next step in the process is the concretion of the fluid within the divided vessel, generally as high up as the nearest collateral branch. The stopper thus formed is commonly of a slender, conical shape, with the apex directed towards the heart. It is seldom sufficiently large to constitute a perfect plug for the vessel, nor does it at first adhere very firmly to its internal surface, excepting at its base, where it is also closely united with the outer coagulum. The connection between the two clots, and the relation which they sustain to the orifice of the divided artery, have been felicitously compared by Beclard to the mouth of a bottle, closed by its stopper, and covered with sealing-wax.

Soon after these coagula have formed beneath, around, and within the divided artery, the different tunics, taking on inflammation, pour out plastic lymph, which serves still farther to seal up the orifice of the vessel, and to strengthen the connection between it and the clotted blood. The absorbent vessels of the parts are also actively engaged in carrying away, at first, the more attenuated, and afterwards the more solid elements of the coagula, until the whole mass is finally transformed into a dense greyish cord, in which it is difficult to discern any trace of the original textures. The period required for the perfection of these changes varies in different cases, depending upon the volume of the vessel, the nature of the wound, and the constitution of the patient.

Such, in few words, is the process employed by nature in arresting hemorrhage from a divided artery. Similar phenomena, very nearly, take place when a vessel of this kind is tied with a ligature, except that there is no external coagulum. The internal clot is also generally more complete; and, as the serous and fibrous membranes are usually cut through, the inflammation is apt to run much higher, the different coats being often rendered extremely vascular and pulpy. The ligature is either removed by absorption, or, as is more frequently the case, it remains until the outer tunic is destroyed by ulcerative action; which, when the artery is small, usually happens in eight or ten days, but, when large, not under several weeks. In whatever way an artery be obliterated, the collateral vessels, as they are termed, are always permanently enlarged, compensating thereby for the lost power on the part of the main trunk. Thus, by the anastomoses of the vascular system, and by the happy contrivance here alluded to, the Creator has provided the means of carrying on the circulation, even after the stoutest branches are completely closed up.

When an artery is wounded longitudinally, or to a small extent obliquely, either an aneurism is formed, or the breach is repaired by adhesive inflammation. The same consequences follow when an artery is punctured with a sharp-pointed instrument, or if it be divided transversely through one-fourth of its circumference. If the vessel be cut across one-half or two-thirds, cicatrization will be impossible; the injured tunics will either yield to their native power of retraction, or they will be destroyed by ulceration. In either case, the final restoration is effected in the same manner nearly as when the vessel is cut across in the first instance.

When an artery is forcibly lacerated, it is much less apt to bleed profusely



than one that is divided by a transverse cut. Cases occur where whole limbs, involving, of course, the largest arteries, are torn from the body, and yet scarcely any blood is lost. The retraction and annular constriction are always much greater here, and the coagula also much larger, as well as more rapidly formed, than under opposite circumstances; and these occurrences, added to the ragged state of the inner and middle coats, and the exhausted condition of the patient, as must always happen in such severe accidents, afford a speedy and effectual barrier to the emission of blood.

*Acute arteritis* is generally induced by external injury, or by an extension of disease from the adjoining structures. Nevertheless, it would seem occasionally to exist as an idiopathic affection, or to come on without any assignable cause. Restricted in the majority of instances to one or more of the larger trunks, it not unfrequently involves the smaller branches, and sometimes even the capillaries. Occasionally the disease appears to pervade nearly the whole arterial system. In a man forty years of age, Dr. Bade, a French author, observed the inner membrane of all the larger arteries thickened, and of a red color, the traces of the inflammation gradually diminishing towards the smaller branches. Examples of a similar kind are to be found in the works of Bertin, Hodgson, and other writers.

When arising spontaneously, the disease usually begins in the internal membrane and subserous cellular tissue, from which it gradually spreads to the other tunics; the reverse happening when it is induced by external violence. The anatomical characters of acute arteritis are redness, opacity, rugosity, and softening of the lining membrane, with an engorged, lacerable, and thickened state of the outer and middle tunics. When the inflammation is severe, the parietes of the affected artery are generally remarkably pulpy, and so much diminished in consistence as to be easily torn or divided by the ligature. The nutrient vessels are loaded with blood, and often exhibit a real varicose aspect, their ultimate twigs ending apparently in the subserous cellular substance. With regard to the redness of the internal membrane, it is liable to considerable diversity; generally speaking, it occurs in small patches, which are diffused over a considerable extent of surface, and which vary in diameter between that of a split pea and a five cent piece. In intensity it ranges from a light pink to a deep scarlet, through numerous intermediate shades of lilac and purple. In some instances the redness is uniform. With this change of color are always associated important alterations of texture. The inner membrane, as was before intimated, losing its smoothness and polish, assumes a rough, fleecy aspect, and, owing to the softened state of the subserous cellular tissue, is easily detached from its natural connections. Globules of lymph, either alone or blended with pus, occasionally adhere to its inner surface; and, in the larger arteries, it is not uncommon to meet with well developed pseudo-membrane, similar in all respects to those of the serous textures of the splanchnic cavities. The other tunics are also seriously affected. They become moist, tumid, friable, and transformed frequently into a reddish, homogeneous mass, almost void of cohesive power. Their elasticity, naturally so great, is partially lost, and in many instances they are freely infiltrated with serosity, sanguinolent fluid, or even pure pus.

Patches of a scarlet, purple, or brownish color, caused by the imbibition of the blood, are sometimes observed on the inner coats of the arteries after death, and are supposed by Corvisart and others to be the result of inflammatory irritation. They are most conspicuous on the under surface of the vessels, or where there is the greatest amount of blood accumulated, and they are frequently witnessed in persons who die of pulmonary phthisis, putrid fever, apoplexy, and malignant cholera. The redness thus produced exhibits the

appearance as if it were dyed into the very substance of the lining membrane, and it commonly exists in stripes, small specks, or geometrical figures, having an abrupt termination: that, on the other hand, which results from irritation generally loses itself by insensible degrees, nor is it diffused over so large an extent of surface. But, however this may be, no difficulty can possibly arise upon the subject, when it is remembered that the inflammatory discoloration is constantly associated with important lesions of the arterial tissues. The cadaveric redness always appears much sooner in warm than in cold weather, and may be produced at pleasure by steeping a vessel for twenty or thirty hours in fluid blood, at a moderate degree of heat.

*Chronic arteritis* is probably a much more common affection than the great silence of the profession respecting it would lead us to infer. Like the acute form of the disorder, it is much more frequently observed in the large than in the small arteries, and hitherto has been noticed chiefly in persons who have died of lesion of the heart, or who have been constitutionally affected by mercury, syphilis, or scurvy. The most prominent feature of chronic inflammation is thickening of the several coats of the artery, which, in protracted cases, may amount to such a degree as to encroach materially upon its caliber. The nutrient vessels are not much injected, and the redness, so conspicuous in the acute variety of the disease, is rarely present in this. The lining membrane, on the contrary, is of a yellowish, dusky, brownish, or greyish tint, interspersed frequently with bluish spots, which thus give it a mottled appearance. All the tunics are abnormally thickened, dense, and brittle, possessing little elasticity or cohesive power. Patches of fibrin are often observed upon the inner surface of the vessel; and, in many instances, the lining membrane is considerably puckered, cracked, or even forced out of its natural situation. The various deposits presently to be noticed, are probably all caused by chronic inflammation.

Although *suppuration* is seldom spoken of by pathologists as an attendant on arteritis, yet I am inclined to believe that it is more frequent than is commonly imagined. The matter being generally poured out upon the inner surface of the vessel, is swept away by the circulating current as fast as it is secreted, which is the reason, doubtless, why it is not oftener noticed after death. Sometimes, however, it is entangled in the substance of the false membranes, infiltrated into the arterial tunics, or collected into small points between the inner and middle tunics. In a case observed by Andral, the serous lining of the aorta was elevated into half a dozen abscesses, each as big as a small nut, and filled with phlegmonous pus. Arteritis is, on the whole, much less liable to terminate in suppuration than phlebitis, in which respect the one resembles inflammation of the serous membranes, the other of the mucous.

*Softening* of the arteries, technically called *arteriomalacia*, is a very common occurrence, but it is much more so in some than in others, and most of all in the smaller branches. It is often witnessed in organic diseases of the principal viscera, and is a frequent attendant upon acute inflammation, cancerous affections, and the application of the ligature. In chronic enlargement of the liver and spleen, the arteries which supply these viscera with blood are often so much changed in their structure that they can be torn, or their coats separated from each other, with the greatest ease. In puerperal fever, the arteries of the uterus are occasionally converted into soft, pulpy, friable, and inelastic cylinders, incapable of withstanding the slightest resistance; and similar phenomena are frequently witnessed in the cerebral arteries in mollescence of the brain and around apoplectic effusions. In the chronic form of the disease, the larger trunks are more commonly involved.

This disease is characterized, as the name indicates, by a diminution of the

cohesive power of the vessel, the coats of which are rendered friable, spongy, and inelastic. When acute, it is generally accompanied with slight tumefaction, engorgement of the capillary vessels, and effusion of serosity or sanguinolent fluid into the interstitial cellular tissue. In the chronic form, however, the coats of the vessel retain their normal thickness, or they may even be diminished in size, and exhibit a dry, shrivelled appearance.

The degree of *mollescence of the arteries* varies from a slight diminution of the natural consistence of the part affected to that of a soft, pulpy, friable substance. In mild cases, or in the incipient stage of the disease, the morbid alteration is often so inconsiderable as to be altogether overlooked. At a subsequent period, however, or when the lesion is fully developed, the diminution of consistence is so great as to be recognized at first sight. The part affected has a tumid, infiltrated appearance, and is converted into a semi-pulpy, friable, and disorganized substance, which readily yields under the pressure of the finger or the handle of the scalpel. This degree of softening is chiefly witnessed in acute inflammation of the parenchymatous organs, attended with effusions of serum, lymph, pus, or some other fluid. It also occurs in erysipelas and gangrene, as well as after the application of the ligature in persons whose constitution has been impaired by old age or the effects of disease. In the chronic form of the disease, the arterial tunics are rather friable than softened; there being no tumefaction, engorgement of the capillary vessels, or infiltration of any kind. They are, in fact, affected with a sort of dry softening, without any other appreciable lesion. They are of the natural thickness, but so brittle that they are incapable of withstanding the slightest force. This form of mollescence is principally observed in encephaloid disease, in osteo-sarcoma, in hypertrophy of the liver and spleen, in softening of the bones, and in chronic enlargement of the joints. In the first of these affections, it is evidently the cause of the frequent hemorrhages of which it is the seat after the establishment of ulceration.

The extent of the softening is extremely variable. It may be limited to a small portion, comprehend the whole circumference of the affected vessel, or be diffused over a surface several inches in length. It may be confined to a single artery, or occur in a great number. It has been described as pervading nearly the whole of the arterial system, especially that portion of it which is connected with the left ventricle. Finally, it may be limited to the individual tunics, or it may affect them all at the same time. The disease, however, is most common in the internal and middle coats, or, rather, in the cellular tissue by which these two layers are united to each other. In idiopathic softening the external tunic often escapes entirely, even when there is great loss of cohesion of the other layers. Hesse,\* a German pathologist, indeed asserts that in a majority of cases the softening is confined to the lining membrane.

The color of the softened part is also liable to vary. When the disease is the result of acute inflammation, as when it is caused by the application of a ligature, the most common discoloration is the red, which is usually most conspicuous in the lining membrane, to which it may be entirely limited, or it may extend to the other tunics. The redness may be circumscribed or diffused, and vary in degree from a light rose to lilac, scarlet, modena, or even purple. In the chronic form of the affection, the softened part presents a pale yellowish, greyish, or dull whitish tint, its natural color being little altered; except, perhaps, in the middle tunic, which is sometimes of a brownish or dull mahogany hue.

Softening of the arteries is sometimes associated with the formation of fibrinous concretions in the interior of these vessels, with tubercular deposits, and with the fibrous, cartilaginous, or osseous degeneration. It always impairs

\* Ueber die Erweichung der Gewebe und Organe des menschlichen Körpers, 1827.



the elasticity of the coats of the affected vessel, diminishes their power of resistance, and predisposes to laceration, dilatation, aneurism, and even perforation.

The arteries may be said to be insusceptible of *gangrene*. Their conservative energies, as stated elsewhere, are surprisingly great, and hence they often escape destruction in the midst of parts that are perfectly deprived of vitality. In such cases, their outer surface becomes incrustated, at an early period of the disease, with a thin layer of fibrin; and, long before the dead textures begin to separate, the blood coagulates in their interior, and thus opposes an effectual barrier to the occurrence of hemorrhage.

*Ulceration*, although a frequent consequence of chronic irritation, is seldom witnessed in the acute form of the disease. Manifesting a peculiar predilection for the larger trunks, it commonly commences in the serous membrane, from which it gradually extends to the middle and outer tunics until it leads to complete perforation. Such a termination, however, must be regarded as extremely rare. The ulcers, which are extremely irregular in respect to their form, vary very much in their size, number, and general characters. At times they are very small, scarcely exceeding the diameter of a mustard-seed; but they may be as big as a split pea, a five cent piece, or even a guinea. Their margins are usually ragged, irregular, and considerably elevated, but seldom injected; their bottom, which is rough and uneven, is commonly formed by the middle tunic, the fibres of which frequently present a shreddy, lacerated appearance. In many instances, the erosions look like so many fissures, cracks, or chaps, with sharp, prominent, and irregular borders. This form of the disease is by no means uncommon, and is ordinarily associated with, or rather, dependent upon, the calcareous deposit. The number of ulcers is seldom considerable, though in a few rare cases the inner surface of the larger trunk has been found completely checkered with them. When confined to the internal tunic, M. Bouillaud thinks that they sometimes admit of cicatrization, — an opinion in which I am disposed to coincide, from having seen several examples of ulcers of the aorta which had obviously been partially repaired.

*Induration* of the arteries, as a pure, uncomplicated affection, is rare. It is usually associated with hypertrophy, or with the fibrous, cartilaginous, tubercular, or osseous degeneration, and is most common in the aorta and its primitive branches. Lobstein states that he has never seen it in the arteries of the superior half of the body; but that it occasionally occurs here, though much less frequently than in the arteries of the lower half, my own dissections abundantly testify. Old age is the period of life most liable to this alteration, which may affect a single vessel, a considerable number, or even the whole of this division of the vascular system; it may involve all the tunics, or it may be limited to one or more of the individual membranes.

An artery, in a state of induration, is preternaturally fragile, devoid, in part, or entirely, of elasticity, and capable of withstanding an unusual degree of lateral pressure. The connecting cellular tissue is remarkably friable, and hence the different tunics may generally be easily peeled from each other. The color of the affected part varies in the different layers; in the serous, it is commonly pale yellowish, interspersed with greyish or reddish brown; in the middle, the more frequent tint is light mahogany, or pale marone; and in the external there is rarely any perceptible alteration from the natural appearance. The lining membrane is often puckered, many of the nutrient vessels are obliterated, and, when the induration is combined with hypertrophy or some of the deposits above mentioned, the caliber of the affected tube may be sensibly diminished in size.

Much less frequent than the deposits now described are the melanotic and encephaloid. These, in fact, are among the rarest affections of the arterial tissue. I have never met with an example of either. When occurring in this

situation, the melanotic matter is usually effused into the subserous cellular substance, in the form of minute dots, or in that of small irregular patches. The encephaloid matter, on the contrary, although it is occasionally seated in the same locality, more frequently occupies the interior of the artery, assuming an arborescent arrangement, and filling up its caliber.

Occasionally we find deposits of *cartilage*, either alone, or, as is more generally the case, in association with calcareous or tubercular matter. Most commonly they are limited to the inner membrane of the arteries, in the connecting cellular substance of which they appear to be developed, in the form of irregular isolated patches, of a whitish, yellowish, or greyish aspect. Not unfrequently, however, they implicate all the tunics, occupying the vessel to such an extent as to convert it into a firm, inelastic tube. Writers are by no means agreed in regard to the question, whether this matter is originally deposited in the form of cartilage, or simply in that of fibrin. The result of my own researches would lead me to adopt the former opinion.

Fig. 59.



Fig. 60.



Deposition of calcareous matter.

59 and 60. In the incipient stage of their development, these depositions

The most common morbid affection of the arteries, by far, is the deposition of *calcareous matter*. It is particularly frequent in old people, after the sixtieth year; but no period of life, except early infancy, is exempt from it. Young found it at fifteen months; Wilson at three years, and Andral at eight. The arteries most commonly implicated are, according to my own observations, the thoracic aorta, the femoral, tibial and fibular, splenic, spermatic, iliac, cardiac, and radial. The deposit is very frequent in the cerebral arteries of old persons, and there is much reason to believe that it often lays the foundation of the apoplectic effusions so common at this period of life. The carotid, subclavian, brachial, hypogastric, hepatic, mesenteric, and stomachic arteries are seldom ossified. In the pulmonary artery, this degeneration is so rare that Bichat was induced to affirm the impossibility of its occurrence. The observations, however, of Morgagni, Stoll, Lobstein, Otto, and others, abundantly show that this assertion is too sweeping. Instances occur where there seems to be a peculiar ossific diathesis, almost all the arteries in the body being rendered bony. Of this I witnessed an extraordinary example in 1834, in a man sixty-five years old, in whom not only the larger trunks, but all the muscular twigs, were transformed into rigid, inelastic cylinders, blunting the knife at every incision. Similar cases have been seen by Riolan, Harvey, Loder, and other authors.

The calcareous matter exists in various forms; sometimes in small grains and nodules; sometimes in scales, plates, and patches; and sometimes in complete rings, which encircle the vessel, and convert it into a firm, inflexible tube, totally devoid of its normal attributes. These appearances are exhibited in Figs.

often consist of minute isolated specks, of a light straw color; and not unfrequently they are associated with other secretions, especially the atheromatous and cartilaginous. In whatever form the matter shows itself, the coats of the arteries always experience important modifications, becoming preternaturally hard and brittle, and either thickened or attenuated. These changes are generally most conspicuous in the two inner membranes, which assume a dense, corrugated appearance, and are extremely liable to break and ulcerate, obliging thus the outer tunic frequently to sustain the whole force of the circulating torrent. The serous lining is often remarkably thick, dense, opaque, and transversely wrinkled.

Destitute of the usual fibrous structure of bone, the calcareous deposit differs still further from this texture in not having, in the greater number of cases, a cartilaginous matrix, in possessing no vitality, and in being always secreted in the form of a homogeneous mass, without any definite arrangement. The component elements of this substance vary in different specimens, even from the same individual; but, in most cases, the proportion of animal matter is small. In the experiments of Brande, one hundred parts were found to consist of sixty-five of phosphate of lime, and thirty-five of albumen, with some traces of gelatine; whereas in those of Vauquelin the animal matter formed only about one-fourth, the remainder being made up of the phosphate and carbonate of lime and soluble salts. Lassaigne found that one hundred parts of an ossified artery contained fifty parts of animal matter, forty-seven and a half of phosphate of lime, two of carbonate of lime, and a few traces of sulphate of lime. The results of these experiments are extremely interesting, because they serve to show, as was before intimated, that the calcareous deposit varies in its composition in different individuals, at different periods of life, in different parts of the arterial system, and even in different portions of the same vessel.

Various opinions have been entertained by pathological anatomists respecting the precise seat of this deposit; some placing it in the substance of the lining membrane, others in the middle coat, others in the cellular texture, by which these two layers are connected together. The latter of these views is borne out by the analogy which is observed in the subserous cellular tissue in other parts of the body; but, independently of this, I am disposed to adopt the opinion from personal observation, too carefully conducted, and too often repeated, to permit me to entertain the slightest doubt upon the subject. At the same time, it must be admitted that this matter may occasionally be poured out in the substance of the different tunics, otherwise we could not account for the deposition being entirely limited, as it sometimes is, to the exterior of the arteries. In regard to the exciting causes of these formations, it will scarcely be going too far to ascribe them wholly to chronic inflammation, seated in the cellular element of the arterial structure.

Another deposit to which the arteries are subject is the *tubercular*. This affection, I have reason to believe, is extremely rare in the native inhabitants of our country, but appears to be very common in Europe and in our foreign emigrants. It usually begins in the cellular substance which connects the inner and middle tunics, in small isolated points, not larger than the head of a pin, of a pale yellowish, white, or brownish color, somewhat greasy to the touch, and of a semi-concrete friable consistence. As these points or dots augment in size, they push the lining membrane beyond its natural level, and if they are at all numerous, or if several of them are seated together, their tendency is to become confluent, and to form irregular patches, which may involve the whole circumference of the tube, and extend several lines or even inches up and down. I have never seen this deposit arranged in streaks or lines,



such as we observe in the degeneration which precedes the formation of bony matter, nor have I found it entirely limited, as it is said occasionally to be, to the inner coat.

After having remained stationary for an indefinite period, this heterologous product manifests a disposition to soften, and is ultimately converted into a friable, curdy substance, possessing apparently all the properties of scrofulous pus. When the disease has reached this point, the lining membrane is frequently elevated into small pustules or little abscesses, which, when ruptured, leave a corresponding number of ragged and irregular ulcers, the base of which is formed by the substance of the middle coat; resulting, probably, from slow chronic inflammation, this lesion is usually associated with the fibrous, cartilaginous or calcareous formation, and with more or less opacity, thickening, and corrugation of the lining membrane. Though the quantity of tubercular matter is seldom very great, yet its tendency uniformly is to impair the elasticity of the arterial tunics, and to dispose them to ulcerative action. The disease is most frequently witnessed in strumous subjects, after the thirty-fifth year. It may occur, however, at a much earlier age, as about the period of puberty, but it has never, I believe, been noticed in infancy and childhood. The most common seat of it is the aorta, particularly the thoracic portion, in the neighborhood of the origin of the great cervical trunks.

The disease of which I have thus given a rapid outline has generally been described by European writers under the vague epithet of the *atheromatous*, *steatomatous*, or *suetey deposit*. The term which I have here ventured to substitute is, I think, altogether preferable, as it designates at once the true nature of the lesion to which it is applied. Should it be objected that the deposit is not in reality of this description, and that, therefore, this name is equally as unphilosophical as the others, I reply that there is nothing to justify such a conclusion, inasmuch as the physical properties of this substance, its mode of secretion, and its final conversion into purulent fluid, all conspire to show its identity with tubercular formations in other parts of the body, especially the bones, testicle, uterus, and seminal vesicle.

Dr. John A. Swett,\* of New York, thinks this deposit is merely a sort of d  tritus, produced by the destruction of the middle coat of the arteries by the presence of osseous matter; and Mr. George Gulliver,† of London, who has recently examined it with much care, looks upon it as of a really fatty nature, similar to the adipous degeneration of the liver and other organs. He states that the fatty matter is often so plentiful as to impart a greasy stain to paper, when dried on it by heat. A microscopic inspection of it brings into view a multitude of crystalline plates and of fatty globules, with albuminous and earthy particles. The crystalline plates, which are said to be of the nature of cholesterine, are of a pearly lustre, and are easily extracted by boiling alcohol. Whether this deposit is really what Mr. Gulliver supposes, must for the present remain unsettled. The fact that it contains cholesterine and oily matter does not prove that it is not of a tubercular nature; at all events, it is perfectly certain that these two substances have never been known to undergo the changes which characterize the transformation we have been considering.

Dilatation of the arteries, constituting what, in surgical language, is termed *aneurism*, is one of the most frequent lesions to which these interesting structures are liable. Varying in size and shape, under different circumstances, the enlargement exists sometimes at one point, sometimes at several,

\* New York Journal of Medicine and Surgery, No. 5, p. 175. July, 1840.

† Medico-Chir. Trans. of London, vol. viii., p. 87. Second series, 1843.

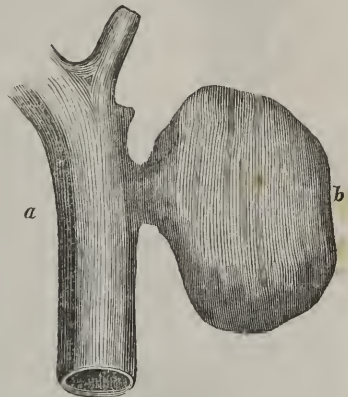
and sometimes is more extensively diffused, occupying the whole circumference of the tube. In the majority of instances, the disease is seated in the larger trunks; but occasionally it attacks the smaller branches, and not unfrequently even the capillaries. Aneurismal enlargements may be divided into five principal varieties—the sacculated, cylindroid, varicose, dissecting, and anastomotic. To these may very properly be added another, namely, the arterio-venous, or that form of the disease which has been described by writers, since the time of Dr. William Hunter, under the name of aneurismal varix.

When a tumor of this kind is composed of all the arterial tunics, it is called a true aneurism; if, on the other hand, it consists only of the external coat, the inner and middle being ruptured, ulcerated, or destroyed, it is denominated a false aneurism. Of these two varieties, the latter is by far the more common. Cases occasionally occur, though rarely, where, in consequence of the laceration of the fibrous membrane, the internal coat is protruded across the crevice, in the form of a hernia, which gradually encroaches upon the cellular membrane, and thus dilates it into a distinct pouch.

In the *sacculated aneurism* (Fig. 61), the coats of the artery are dilated into one or more pouches, occupying only a limited portion of its circumference. It occurs most frequently in the great trunks, particularly the thoracic aorta, and occasionally affects all the principal branches of the body. M. Pelletan, a French surgeon, examined an individual, in whom he discovered upwards of sixty of these dilatations; and a still more extraordinary example has been reported by Jules Cloquet, of Paris. In this case, the number of tumors was upwards of two hundred, the largest of which did not exceed the volume of a common pea.\* There would thus seem to be occasionally a real aneurismal diathesis. Much diversity obtains in relation to the dimensions of these sac-like projections: in some instances, as has just been seen, they are remarkably small, whilst, in others, they acquire the magnitude of a large egg, the fist, or even of a mature foetal head. The manner in which they are attached is also subject to considerable variation, but generally it is by a narrow foot-stalk or a tolerably broad base.

The orifice of communication between the sac and the artery varies in different preparations. When the tumor arises by a narrow foot-stalk the opening is usually proportionably small, with smooth and well-defined margins. When, on the other hand, it is attached by a broad base, the aperture is always much larger, and its edges are also more irregular, sometimes, indeed, quite shreddy and ragged, as if they had been torn. The situation of the orifice is commonly towards the centre of the sac, but it may be at one side, or even at one of its extremities. The form of the opening is extremely variable, and admits of no specific description. In the early stage of the disease, and in nearly all cases

Fig. 61.

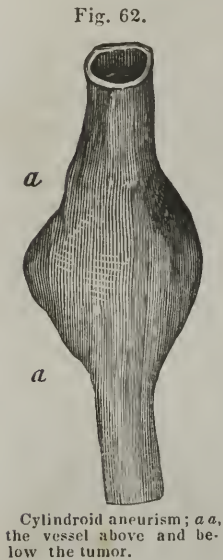


Sacculated aneurism; a, artery; b, aneurismal pouch.

\* The subject in whom these dilatations were found was about fifty years of age. They affected almost every artery in the body, even the aorta and its principal divisions, but they were most numerous in the extremities. The axillary, humeral, radial, and ulnar arteries, the femoral, popliteal, tibial, and peroneal, were closely studded with them. In volume they varied between that of a millet-seed and a large pea. In other respects, the coats of the vessels were perfectly healthy. (Pathologie Chirurgicale, par Jules Cloquet, p. 86.)

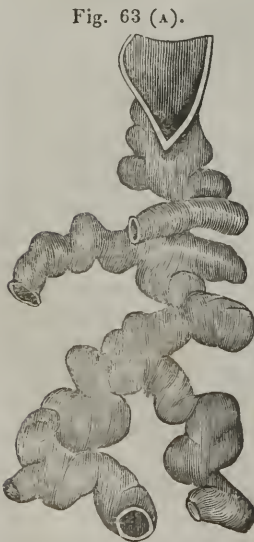
where the tumor is small, the orifice is of a rounded or circular configuration, while in cases of an opposite character it is generally more or less irregular. The internal and middle tunics may terminate abruptly at the margins of the opening of communication, or they may extend into the cavity of the sac, and thus serve to give it a partial lining.

The *cylindroid aneurism* (Fig. 62), is of an elongated spherical shape: the dilatation, which is pretty nearly uniform, embraces the entire circumference of the vessel, varying in length from a few lines to several inches. The coats are generally somewhat thickened, and the inner surface of the tube is rough, uneven, and covered with thin, irregular layers or patches of fibrin. In some instances, the dilatation is truly enormous. In a specimen of cylindroid aneurism of the arch of the aorta, presented to me by my friend Dr. W. M. Charters, of Lebanon, Ohio, the tumor measures upwards of ten inches in circumference, by five and a half in length. It formed an immense ovoidal swelling in front of the neck, which extended nearly as high up on the left side as the angle of the jaw; whilst, below, it pressed upon and destroyed the inner half of the clavicle, part of the first rib, and a small portion of the breast bone. Almost all the arteries in the body are sometimes affected with this species of enlargement. In a man, fifty years of age, Dr. Geddings, the distinguished Professor of Surgery, in the Medical College of South Carolina, found not only the larger trunks, but nearly all the principal branches, dilated to at least double the normal size. The superficial temporal arteries were nearly as capacious as the main vessel of the arm, and the same circumstance was observed in the bigger branches of the brain.\*



Cylindroid aneurism; a a, the vessel above and below the tumor.

The *varicose aneurism* (Fig. 63, A), consists, as its name imports, in an enlarged and nodulated state of the artery, similar to that of a varicose vein. The dilatation ordinarily embraces a considerable portion of the length of the vessel, the coats of which are at the same time very thin and brittle, preternaturally light, and readily collapse when divided. In this variety of the disease, the artery is remarkably elongated, tortuous, and convoluted; the lesion seldom occurs in the larger trunks, but is most frequently observed in the secondary and ternary divisions, as the splenic, carotid, humeral, femoral, tibial and radial, temporal, and occipital.



The *dissecting aneurism* (Fig. 63, B), although incidentally noticed by Morgagni, was first described by Laennec,† who devised the name by which it is now usually designated. Two examples of the disease were subsequently published by Mr. Shekelton, in the third volume of the Dublin Hospital Reports, and shortly afterwards Mr. Guthrie, of London, called particular attention to it in his work on the Diseases and Injuries of the Arteries. Within the last

\* American Cyclopædia of Practical Medicine and Surgery, vol. ii., p. 413.

† De l'Auscult., t. ii., p. 700.

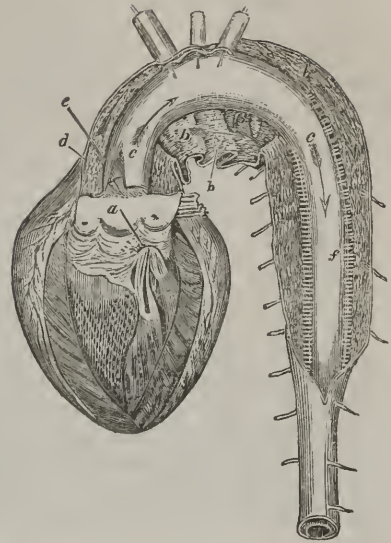


few years, highly interesting cases of it have been reported by Dr. Pennock and Dr. Goddard, of Philadelphia, Dr. Washington, of New York, and Professor Henderson, of England.

The lesion, which is entirely limited to the aorta and the large trunks which arise from it, or in which it terminates, consists in a separation of the middle and external tunics of the affected vessel, preceded by ulceration, fissure, or rupture of the lining membrane, caused by the force with which the blood is impelled against it by the contraction of the left ventricle of the heart. Such, at any rate, is the account usually given by pathologists of the nature of this affection; but the observations and dissections of Dr. Pennock, confirmed by a careful personal examination of nearly all the published cases of dissecting aneurism, render it exceedingly probable that it is generally situated between the lamina of the middle tunic, and not between the latter and the external. The manner in which the lesion takes place is easily understood. In the natural state the different coats are so intimately connected together, that it is almost impossible, even by the nicest dissection, to detach them from each other; but when they are altered by disease, or by some of the degenerations to which they are so liable, the connecting cellular tissue is rendered soft and friable, and their separation may then be effected with the greatest facility. In this condition, moreover, the tunics themselves are frequently very much changed, so that they are scarcely able to resist the slightest impulse. Now, if under these circumstances the lining membrane gives way, whether from ulceration, erosion, or rupture, the blood will insinuate itself into the accidental opening, which is thus gradually enlarged, at the same time that the fluid is forced on between the layers of the weakened middle tunic, dissecting them from each other as with a knife, and forming thus either a blind pouch, or a distinct canal, open at both extremities, or at some intermediate point.

The detachment is not of the same extent in all cases. It very rarely, in fact, embraces more than one-fourth, one-half, or two-thirds of the circumference of the tube, while in length it may vary from six, eight or ten lines to as many inches. Occasionally it reaches nearly from one extremity of the aorta to the other, being perhaps prolonged at the same time into the carotid, subclavian, and iliac arteries. The new channel is seldom of uniform size, but is apt to be larger at some points than at others; it runs parallel with the old canal, lying either in front or on one side of it, and is always lined by an adventitious membrane, thicker than the corresponding membrane of the aorta, of a fibro-serous nature, semi-transparent, and of a light marone, yellowish, or greyish brown colour. The septum between the two tubes is composed of the internal membrane and of one or more of the lamellæ of the middle tunic,

Fig. 63 (B).



The appearances presented by the dissecting aneurism are depicted in Fig. 63 (B), from Pennock: *a*, semilunar valves; *b*, external vessel laid open in its entire extent, so as to expose the aorta at *c*; *d*, valvular opening in the coats of the aorta, showing the communication of this vessel with the artificial channel; *e*, the probe *e* passes through the abnormal opening; *f*, shows the foramina between the aorta and the outer canal.

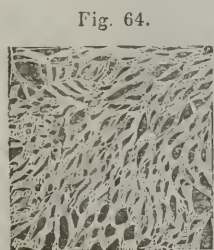
which are usually considerably hypertrophied, and much firmer than in the natural state.

The accidental channel presents itself either in the form of a pouch or cul-de-sac ; or, after descending some distance, it communicates with the old canal by a distinct rent. In the latter case the aorta strongly resembles a double artery, as in the interesting example recorded by Henderson. The inlet of the factitious route is generally a mere slit or fissure, with thin, ragged edges, from six lines to an inch and a quarter in length, and directed transversely, obliquely, spirally, or longitudinally. The inferior opening, or outlet, is also liable to much diversity, both in regard to its size, shape, and inclination ; but generally it is considerably smaller than the upper, from which it may be situated from five to eight or even ten inches. The apertures of communication between the old and new channels are sometimes multiple, as in the case recorded by Dr. Pennock, where there were as many as five, two at the arch of the aorta, one at the cœliac axis, and two at the renal arteries. When the openings are so numerous, they are generally nothing but the orifices of pre-existing vessels, the relations of which have been changed by the abnormal separation. The external tunic may be variously altered in this affection, but in a majority of cases it is comparatively sound.

In some cases the new vessel compresses the old, changing its direction, and assuming its functions. The blood, however, never passes entirely along the collateral route, and hence the original vessel always preserves its tubular form.

The dissecting aneurism appears to be most common in women after the fiftieth year. In six cases, where the sex is mentioned, I find that the patients were all females, four of whose ages respectively were fifty, sixty, seventy-five, and one hundred. In seven cases, of which I have been enabled to obtain the particulars, the heart was hypertrophied in all, in some of them enormously ; there was also more or less disease of the mitral or semi-lunar valves, or of both ; and the aorta was either ossified, sacculated, or the seat of atheromatous deposits. Death in several of the cases was caused by a rupture of the aneurism, and an escape of blood into the pericardial sac.

The *anastomotic aneurism* (Fig. 64), usually described by the German pathologists under the name of *telangiectasy*, is composed of a congeries of convoluted capillary arteries and veins, dilated into a soft pulsating tumor, generally of a bright florid tint, but occasionally of a bluish, mulberry, or purple color. In some instances, it appears as a congenital disease, constituting what is called a *navus maternus*. When of long standing, the vessels are often dilated into small sacs, and so form a truly erectile tissue, analogous to that of the penis, nipple, or wattles of the turkey-cock. Although every part of the capillary system is probably susceptible of this singular dilatation, yet the most fre-



quent situations of anastomotic aneurism are the head, hands, and feet. In a few rare instances, it has been observed on the gums and inside of the cheeks. There is a form of hemorrhoidal tumor, which, as will be subsequently shown, is probably merely a variety of anastomotic aneurism.

A tumor of this kind throbs synchronously with the heart, has a soft, spongy feel, and becomes smaller when compressed, but immediately regains its former volume when the pressure is withdrawn. Violent excitement of the heart renders it preternaturally turgid, and the same circumstance follows when there is an impediment in the venous circulation. This species of aneurism often

acquires a considerable magnitude. Its progress is not always rapid; occasionally, indeed, it remains stationary for years. Ultimately, however, ulceration sets in, and, in this way, the tumor becomes the seat of frequent hemorrhages.

*Spontaneous aneurism* is much more common in some arteries than in others. The following table, compiled by Lisfranc, exhibits the relative frequency of this disease in the different arteries in 179 cases, excluding those of the aorta:—

1. Popliteal	-	-	-	-	-	59
2. Femoral	} at the groin					26
	} at other points					18
3. Carotid	-	-	-	-	-	17
4. Subclavian	-	-	-	-	-	16
5. Axillary in the arm-pit	-	-	-	-	-	14
6. External iliac	-	-	-	-	-	5
7. Innominata	-	-	-	-	-	4
8. Humeral	-	-	-	-	-	3
9. Common iliac	-	-	-	-	-	3
10. Anterior tibial	-	-	-	-	-	3
11. Gluteal	-	-	-	-	-	2
12. Internal iliac	-	-	-	-	-	2
13. Temporal	-	-	-	-	-	2
14. Internal carotid	-	-	-	-	-	1
15. Ulnar	-	-	-	-	-	1
16. Peroneal	-	-	-	-	-	1
17. Radial	-	-	-	-	-	1
18. Palmar	-	-	-	-	-	1

In another table, constructed by Mr. Hodgson, and founded upon sixty-three cases, embracing, however, twenty-nine of the aorta and innominata, the results are as follows:—

Femoral and popliteal	-	-	-	-	12
Inguinal	-	-	-	-	15
Subclavian and axillary	-	-	-	-	5
Carotid	-	-	-	-	2

From these tables it is obvious that the disease under consideration occurs more frequently in the popliteal arteries than in any other individual trunks, and considerably oftener in the arteries of the lower extremities than in all the other branches of this portion of the vascular system put together. The principal cause of these differences is the greater frequency of the fibrous, fibro-cartilaginous, and osseous degenerations of the coats of the vessels of the inferior extremities than those of the superior, which are seldom assailed in this manner. Aneurism of the pulmonary artery is exceedingly rare.

With regard to the liability of the two sexes, the opinion is general and well-founded that men are much more subject to aneurism than women. Mr. Hodgson, in his excellent work on the diseases of the arteries, gives an account of sixty-three cases, of which number fifty-six were males, and seven females. Of one hundred and eighty-nine cases, analysed by Bizot, one hundred and seventy-one were men, and only eighteen women. In one hundred and fifty-four cases, collected by Lisfranc, none of which could be



the subject of a surgical operation, the proportion was one hundred and forty-one males to thirteen females, or nearly as 11 to 1. Similar observations, only on a much less extended scale, have been made by Scarpa, Guthrie, Langenbeck, and other pathologists. This peculiarity, for such it must be considered, of the male sex, is doubtless to be attributed to their more active life, and consequently to their greater exposure to violent exercise and all kinds of hardship, which are the ordinary exciting causes of the aneurism; while women generally lead a more sedentary life and are comparatively exempt from accidents.

Spontaneous aneurism is emphatically a disease of advanced life. The following tables, constructed by Bizot\* and Lisfranc,† place this subject in a very satisfactory light. It is proper to observe, that the cases analysed by the former of these authors were collected from the writings of Morgagni, Corvisart, Laennec, Scarpa, Boyer, Hodgson, Richerand, and S. Cooper.

Bizot.	Number of Subjects.	Lisfranc.	Number of Subjects.
From 10 to 19	- - 1	From 10 to 15	- - - 1
20 29	- - 15	15 20	- - - 3
30 39	- - 35	20 25	- - - 5
40 49	- - 31	25 30	- - - 12
50 59	- - 14	30 35	- - - 24
60 69	- - 8	35 40	- - - 15
70 79	- - 2	40 45	- - - 20
80 89	- - 2	45 50	- - - 17
	<hr/>	50 55	- - - 11
	108	55 60	- - - 6
		60 70	- - - 3
		70 80	- - - 3
			<hr/>
			120

From these tables, comprising an aggregate of two hundred and twenty-eight cases, it would appear that spontaneous aneurism occurs most frequently between the ages of thirty and fifty. In the ten years above and below that period the diminution is very remarkable. Before twenty and after sixty the disease is very rare. The dissecting aneurism is most common in old people; the anastomotic in infants and children.

The sixth and last form of dilatation which I shall notice, is the *arterio-venous* (Fig. 65), or, as it has generally been denominated since the time of Dr. William Hunter, who first described it, *aneurismal varix*. Although this lesion is most apt to happen at the bend of the arm, where the median basilic vein lies over the humeral artery, yet it may occur in any part of the vascular system in which two considerable sized trunks of this kind are contiguous. In most instances, it follows upon the operation of venesection, but occasionally it arises spontaneously, or, more properly speaking, as the effect of ulceration.

When produced by a sharp-pointed instrument, as, for instance, the lancet, the superficial wound generally heals by the first intention; but that between the two vessels remains permanently patent, and thus allows the blood to flow readily from one to the other. By degrees the channel here established aug-

\* Recherches sur le Cœur et le Système Arteriel chez l'Homme, dans "Memoires de la Société d'Observation Médicale de Paris," t. i., p. 400.

† Edinb. Med. and Surg. Journ., vol. xlv., 194.

ments in diameter, and the two vessels are either effectually agglutinated together, or their connecting cellular substance is injected with blood, so as to form a sort of globular pouch. The artery and vein, in the mean time, become sensibly altered, both as respects the size of their caliber and the texture of their parietes. The former, which now receives black blood, is gradually dilated into a soft, thin, flexuous tube, which ultimately acquires all the properties of a vein. These changes, which are always more distinctly marked in the immediate neighborhood of the preternatural aperture, frequently extend as low down as the first large collateral branch, and their invariable effect is to obscure the pulsation in the corresponding part of the limb. The vein also loses, in some measure, its normal characters. It becomes large and tortuous, both above and below the seat of the injury, acquires an extraordinary degree of density, and is no longer either so extensible or elastic. The cause of these textural changes is chronic inflammation, leading, in the one case, to partial atrophy, in the other to partial hypertrophy; or, in other words, what one vessel loses, the other gains.

This species of aneurism, which is generally of slow formation, seldom acquires any great bulk. It may be as big as an egg, but ordinarily it does not exceed the volume of a common plum. It communicates to the hand a sort of jarring sensation, and to the ear a peculiar hissing sound, not unlike what would result from the prolonged articulation of the letter R, which are the pathognomonic signs of its existence.

Most of the species of aneurism here enumerated, are dependent, directly or otherwise, upon an altered or modified state of the arterial tissues. The internal and middle tunics are commonly most affected; indeed, it is rare to find them perfectly free from disease. The calcareous, cartilaginous, or tubercular deposits, noticed in a previous page, are usually present; and oftentimes the aneurismal pouch is exclusively formed of the outer coat, the other two being entirely destroyed. In the sacculated variety of the disease, as well as in some of the rest, one of the earliest effects consequent on the development of the tumor, is the deposition of the fibrin of the blood, as this fluid sweeps over its inner surface. This deposition, which generally occurs in concentric layers (Fig. 66), is sometimes remarkably abundant. Its thickness varies from six to eight lines, according to the age and size of the sac, but it may exceed two inches. The oldest lamellæ, or those lying directly in contact with the inner surface of the tumor, are generally of a whitish, greyish, or yellowish color, remarkably hard, dry, and brittle; whereas, those which are of recent formation, are always of a darker hue, soft, and elastic.

Fig. 65.



Arterio-venous variety of aneurism; *a*, the artery; *b*, the vein; *c*, the opening between them.

Fig. 66.



The *duration* of aneurism is influenced by so many extraneous and intrinsic circumstances that it is impossible to lay down any specific rules in regard to it. In a majority of cases it does not exceed six or eight months, while in many it terminates much sooner, and in a few it may continue from one to two or three years. The disease proves fatal much earlier in old persons than in the young or middle aged, and in false than in true aneurism. Aneurism by anastomosis may last for many years before it bursts, and the same remark is true of the varicose and arterio-venous forms of the affection. The occupation of the patient, the situation of the tumor, the state of the arterial tunics, and the energy of the circulation, are the circumstances which mainly influence the duration of the disease.

An aneurismal tumor, after having attained a certain size, manifests a disposition to burst, which it does either as an effect of ulcerative absorption, or as a consequence of inflammation and gangrene. In either case, life is destroyed in the same manner, namely, by hemorrhage, which may be sudden and copious, or slight and gradual, according to the extent of the accidental opening. In the neck, groin, and extremities, the tumor generally breaks upon the surface; in the chest and abdomen, into the serous cavities or into some of the adjoining viscera. Aneurism of the arch of the aorta usually bursts into the pleura, pericardium, trachea, bronchial tubes, œsophagus, or posterior mediastinum. Rupture into the substance of the lungs is very rare. Sometimes a communication is established between the tumor and the heart, or between it and the pulmonary artery. Hope met with an instance in which an aneurism at the origin of the aorta opened into the right ventricle; and examples of the latter occurrence have been observed by Payen, Zeink, Wills, and Monro.\* The tumor has also been known, though very rarely, to burst into the spinal canal, one or more of the bodies of the vertebræ having been previously destroyed by ulcerative absorption. Meriadec Laennec has recorded a case of this kind in the *Revue Médicale* for 1825, and about the same period an example of a similar description was published by Saloman in the *Medical Transactions of St. Petersburg*. Pennock of Philadelphia, Chandler of London, and Beatty of Dublin, have each met with this mode of termination. Aneurism of the abdominal aorta may burst into the peritoneal cavity, stomach, bowels, or urinary bladder.

Aneurism does not necessarily prove fatal. Nature occasionally sets up a process of reparation, and of this there are not less than five different modes, all founded, however, upon the same principle.

1. The most common process is the formation of fibrinous concretions, by which the whole interior of the sac, with the exception of a small narrow channel, is gradually filled up; the affected artery itself remaining pervious, and carrying on the circulation. Of this variety of cure many examples are on record. The most interesting specimen of the kind that has fallen under my observation was presented to me by a former pupil, Dr. Shumard. The tumor, which involved the hepatic artery of a young bullock, was of the volume of a large goose-egg, of a globular form, and occupied by an immense number of concentric lamellæ, of a dense, firm texture, of a pale greyish tint, and strongly united to each other and to the enclosing sac by short cellular substance. The affected artery was perfectly free, and the blood passed readily from one orifice of the vessel to the other, across a sort of groove or channel in the upper part of the tumor. In some instances the aneurismal sac is completely filled by the fibrin, the artery is obliterated, either partly, or in the whole of its length, and the circulation is entirely arrested.

\* Hope, on the Diseases of the Heart, by Dr. Pennock, p. 410.



2. Reparation may be effected by the development of inflammation, accompanied by the coagulation of the blood both in the sac and in the artery, and followed by profuse suppuration. Ulcerative absorption takes place, and the matter is discharged along with the contents of the tumor, the sides of which gradually approach each other, and finally unite by granulations.

3. Tumors are sometimes developed in the course of the affected artery, and by pressing upon it, either on the cardiac or capillary side of the aneurism, may lead to the coagulation of the contents of the latter, and the occurrence of a spontaneous cure. Sir Astley Cooper met with a case in which this process took place from the bursting of an aneurism beneath the common integuments, and the consequent obliteration of the artery by the pressure of the effused blood. The same effect may be produced by the aneurism itself, especially when of large size, overlapping and blocking up the connecting artery.

4. A fourth mode is by gangrene, commencing either in the sac itself, or in the structures immediately around it. The blood coagulates here as in gangrene of other parts of the body, the contents of the sac are discharged along with the sloughs, an abundant suppuration is established, granulations spring up, and the affected artery is not only obliterated but ultimately transformed into a dense, ligamentous cord. This mode of reparation, like the last two, is very infrequent, for the patient usually dies either from the violence of the morbid action or from the effects of hemorrhage.

5. A rare process of reparation, not usually recognized by pathologists, but which, nevertheless, I conceive might occur, is mentioned by Richter. This eminent surgeon supposes that a clot of blood, detached by a blow, contusion, or violent concussion, may find its way into the opening of communication between the aneurism and the artery, and thus effectually intercept the circulation in both.

Soon after the circulation within the aneurismal pouch is fairly arrested, whether by the formation of fibrinous concretions, the invasion of gangrene, or the effusion of purulent matter, a process of absorption commences, leading to important changes in the debris of the tumor. The internal concretions are transformed into pale, whitish, yellowish, or greyish lamellæ, while the cyst by which they are surrounded assumes the character of a dense, fibrous membrane, altogether unlike the coats of the artery with which it is connected, and of which it originally formed a part. Whether the tumor is ultimately entirely absorbed, or whether a portion of it remains, and gives rise to the little nodules described by Corvisart, Hodgson, Guthrie, and other writers, as being occasionally seen on the exterior of the aorta and other large vascular trunks, is a question which we have no means of determining. The general opinion is, that these bodies are nothing but aneurismal sacs, which have been filled up by lamellated coagula, and the volume of which has been diminished by absorption. Corvisart\* was the first to notice an affection of this kind. Having opened the chest of an individual whose previous history was unknown, he found on the anterior part of the arch of the aorta a small black tumor, of the size of a walnut, and firmly adherent by its base to the side of the vessel. It was surrounded by a dense, fibrous membrane, nearly two lines in thickness, and contained a substance, of a deep red color, a little less consistent than suet, and closely resembling the coagula of an old aneurismal sac. No communication existed between the interior of the tumor and the cavity of the aorta, the outer layers of which were greatly attenuated and even partially destroyed at this particular point. A similar tumor, only somewhat smaller, was discovered in the aorta a little above the cœliac axis. In 1786,

\* Essay on the Organic Diseases of the Heart and Great Vessels, p. 242: Philadelphia, 1821.

in dissecting the body of another individual, Corvisart met with two or three nodules of the same description on the ventral aorta, and also one on each of the common iliac arteries. In a case related by Mr. Hodgson,\* the tumor, situated at the anterior part of the arch of the aorta, was of the volume of a small apple, very solid, and composed of firm but distinct layers of coagulum, of a whiter and more fleshy appearance than it is met with in recent aneurisms. The interior of the sac had formerly communicated with that of the aorta, by an opening about the size of a half crown, which was now closed by the base of the coagulum, the surface of which had a smooth, membranous arrangement. The cavity of the aorta, however, was entirely unobstructed, but its coats were thickened and considerably dilated, particularly at the origin of the arteria innominata and the root of the tumor, which seemed to be formed by the rupture of the diseased tunics of the vessel.

Corvisart was inclined to look upon the tumors which came under his observation, and of which I have given a succinct account, as incipient aneurisms, and in this opinion he is followed by Mr. Guthrie. Mr. Hodgson, however, more justly, as I think, considers them as aneurisms in a state of partial or complete reparation. His own case was certainly of that description, and so are several others that have been reported since the publication of the work of that distinguished pathologist.

The influence which aneurism exerts upon the adjacent structures varies according to the size and situation of the tumor. As long as the sac is small the effects will be proportionably slight, if not imperceptible; but as it augments in volume, it will necessarily produce more or less pressure upon the parts with which it lies in contact, and thus lead to changes of a marked and serious character. In the neck the tumor may embarrass the circulation of the jugular vein, and thereby cause cerebral congestion, headache, vertigo, and intumescence of the face. By compressing the trachea and œsophagus it may occasion difficulty of respiration and deglutition. In aneurism of the thoracic and abdominal aorta, the heart, lungs, and other organs are liable to be displaced, deformed, partially atrophied, and more or less changed in their structure. The thoracic duct and vena cava are sometimes very much compressed, and partly, or even entirely obstructed. Sir Astley Cooper relates an instance in which the common carotid was obliterated by the pressure of an aneurism of the aorta, and Hodgson another where the same circumstance happened to the left subclavian. Dr. Hope met with two cases in which the left carotid and subclavian were plugged up at their origin from the tumor; and he adds, that the obliteration may be effected by lymph, or by contortion or compression of the vessel. In aneurism of the popliteal artery the pressure of the tumor often intercepts the passage of the blood in the branches below, so as to lead to gangrene of the whole limb.

The bones in the neighborhood of the aneurismal tumor frequently experience important changes. The pieces most liable to suffer are the vertebræ, ribs, sternum, and clavicle, which may be eroded, ulcerated, excavated, atrophied, or even in great measure destroyed. The cartilages, fibro-cartilages, ligaments, and aponeuroses seldom undergo much alteration, no matter how great or protracted the pressure exerted by the tumors. The muscles are wasted, changed in color, and transformed into thin, elongated, riband-shaped bands; the nerves are stretched and flattened; the cellular tissue is infiltrated with serum and lymph; and the skin, gradually attenuated, is ultimately invaded by ulceration or gangrene. In cases of long standing, the soft parts around the tumor are sometimes very much condensed, and a sort of adventitious cyst is formed, similar to what is observed in certain forms of chronic abscess.

\* Op. cit.

The *diagnosis* of aneurism of the extremities, neck, groin, and axilla, is usually not difficult. There is a pulsating tumor, either of a globular, ovoidal, or cylindrical figure, which subsides under pressure, but immediately refills with a peculiar whizzing noise as soon as the finger is removed. The progress of the disease is generally rapid, and there is feebleness of pulse, with numbness and œdematous swelling in the parts beyond the disease. Internal aneurism, on the other hand, is always difficult of detection, especially in the early stage of its development. When seated at the arch of the aorta, it simulates lesions of the heart, and is not easily identified. The physical signs upon which our reliance is mainly to be placed, are limited to a preternatural loudness in the pulsations at the upper part of the sternum, often accompanied by a bellows-sound, and dullness on percussion over the same region. In the abdominal portion of the aorta and the common iliaes, the tumor can frequently be recognized by its great bulk and violent beating. Of aneurism of the pulmonary artery no diagnostic system has yet been pointed out.

*Hypertrophy* is well exemplified in the arteries of the uterus during gestation, and in the growth of various tumors, especially such as attain a great bulk. In these states of the system they often become extremely capacious, elongated, and tortuous, being coiled up like varicose veins. The object of this augmentation of volume is to allow a larger quantity of blood to flow into the growing part; and hence, in the instance of the uterus, we find that, as soon as the child is expelled, the dilated and thickened arteries gradually revert to their former dimensions. Hypertrophy of these vessels is generally associated with hypertrophy of the veins, and is, in most cases, purely physiological, there being no discernible lesion whatever of their tunics.

*Contraction* of the arteries, either alone or associated with dilatation, occasionally exists as a congenital defect; but, in the great majority of instances, it is the result of inflammation, most commonly of the chronic kind, giving rise to fibrinous concretions, tubercular deposits, or calcareous degeneration. In this way, the caliber of the vessel is sometimes completely obliterated, and its texture transformed into a dense ligamentous cord, the circulation being carried on by enlarged collateral channels in the same manner as when an artery is secured by ligature. Hitherto, this lesion has been observed more particularly in the larger trunks, especially in the aorta, but no part of the arterial system is exempt from it. Indeed, there would occasionally seem to be a peculiar predisposition to this contraction, the capacity of almost every vessel in the body being sensibly affected by it. The pulmonary artery, although seldom implicated, is sometimes remarkably contracted. In a case observed by Dr. Knox, of Edinburgh, it was reduced to the size of a small goose-quill. Examples of contracted aorta have been reported by numerous pathologists. One of the most extraordinary and instructive that has yet been published is narrated by Meckel. It occurred in a Swiss peasant. The aorta, near the arterial duct, was diminished to the volume of a common straw. All the collateral vessels were enormously dilated, and many of them resembled varicose veins.\*

\* North American Archives of Medical and Surgical Science, vol. i., p. 155



## CHAPTER VI.

## OF THE VEINS.

More numerous and capacious than the Arteries. — Tunics and Valves; proper Vessels and Nerves. — Lesions. — Acute Inflammation. — Suppuration. — Ulceration. — Chronic Inflammation. — Dilatation. — Obliteration. — Calcareous Deposits. — Phlebolites. — Admission of Air.

THE veins are much more numerous than the arteries, and their united capacity is nearly three times as great. In their general arrangement, structure, and mode of distribution, the closest resemblance exists between the two species of vessels; but it may be observed that the former are more tortuous, that their parietes are thinner, that their anastomoses are more frequent, and, finally, that they are not so regularly cylindrical. Their elasticity, although well marked, is not so great as in the arteries; and their extensibility is likewise less in the longitudinal direction, but more conspicuous in the lateral. In most parts of the body there are two veins to one artery: in some organs, however, as in the stomach, spleen, and testicle, the two species of vessels exist in equal number; and, in a few rare instances, as in the penis, clitoris, and umbilical cord, there is only a single vein to two arteries. The general arrangement of the veins is arborescent, but in a manner the reverse of what obtains in the arterial system; that is to say, they begin in the remote parts of the body by minute rootlets, which increase in size as they diminish in number, forming thus a series of branches, which finally resolve themselves into several large trunks, which terminate in the auricles of the heart; — those of the general system conveying black blood, those of the lungs, blood that has been exposed to the influence of the atmosphere.

Although the tunics of the veins bear a general resemblance to those of the arteries, yet they differ from them in several important particulars, which require brief comment in this place.

The outer tunic is composed of the same substance as that of the arteries, but is much less strong and dense: it is liberally supplied with vessels, and is connected to the surrounding organs by a sheath of loose, cellular texture. The middle coat is also comparatively thin, and is formed of soft, reddish, extensible fibres, disposed for the most part longitudinally. In the large veins, a few appear to run obliquely, transversely, or spirally; but this arrangement cannot always be satisfactorily made out. This lamella is supposed by some anatomists to be of a muscular nature, — an opinion for which, so far as my observation enables me to judge, there is no just foundation. It is, doubtless, merely a modification of the yellow fibro-elastic texture which forms so abundant an ingredient of the corresponding coat of the arteries. The middle tunic is proportionally thicker in the small than in the large veins: it is also more distinctly developed in the superficial vessels than in the deep-seated, and in the veins of the inferior half of the body than in those of the superior. In certain situations, as in the sinuses of the bones and of the dura mater, it is entirely deficient, as is also the external, the serous membrane being alone discoverable.

The internal coat, besides being much more delicate and extensible than the corresponding one in the arterial system, is likewise less brittle, and less liable to ossification. It forms, moreover, by its duplications, an immense

number of valves, the presence of which is of essential importance to the venous circulation. Each fold is of a semi-lunar shape, the convex edge being attached to the circumference of the vessel, whilst the other, which is straight, slightly concave, or reticulated, is loose, and directed towards the heart. The lamellæ of which it is composed are somewhat thicker at the borders than at the middle; and they are connected together by cellular substance, which is so short and firm as to render it extremely difficult to separate them by means of the knife. In most of the vessels, the valves occur in pairs; in some, as in the iliac and femoral veins, they are triple, and in a few even quadruple. In the smaller branches the folds are single; and a similar arrangement exists at the mouth of several of the larger trunks, such as the coronary vein of the heart and the inferior hollow vein of the trunk.

In regard to the number of valves, much variation exists in different regions of the body. They are remarkably abundant in the superficial veins, less so in the deep-seated, and in the splanchnic cavities there are scarcely any; they are also more numerous in the inferior than in the superior extremity, and in the subcutaneous vessels of the abdomen than in those of the chest. In certain situations, these structures are absent. There are no valves in the liver, spleen, kidney, uterus, brain, or spinal cord; and they are likewise wanting in the portal vein, the great hollow veins, and in the median vein of the arm. There are very few in the azygos and pulmonary veins.

Like the arteries, the veins have their appropriate vessels, nerves, and lymphatics: they are surrounded by loose cellular substance; and, during life, they are always of a bluish tint, owing to the remarkable tenuity of their parietes, which allows the color of the blood to appear through them. After death, they are whitish, semi-transparent, and collapsed.

*Acute inflammation* of the veins is much more frequent than in the arteries; the reverse being the case in respect to the chronic form of the disease. It usually implicates a large extent of surface, often affecting a number of veins simultaneously, and, what is remarkable, always tends to spread in the direction of the heart. The anatomical characters of this disorder are swelling, opacity, and pulpiness of the internal membrane, with uniform redness, varying from light pink to deep florid. The middle and outer coats soon become deeply injected, and their proper substance, although at first preternaturally soft and humid, is at length rendered so dense and firm, that the vein feels like a hard, contracted cord. The cavity of the inflamed vessel is filled with clotted blood, sometimes blended with pus or lymph, and in many cases it is lined by a false membrane, susceptible, under certain circumstances, of organization. Instances occur in which the pus is infiltrated into the substance of the vein, or collected into small abscesses beneath the lining membrane.

*Suppuration* is very liable to occur in the veins of the uterus and inferior extremities of lying-in females. This fact seems to have been first noticed in 1793, by Dr. John Clarke, of England. It soon afterwards attracted the attention of Meckel and Reil, of Germany; and very recently, the subject has been developed, in all its bearings, by Dr. Robert Lee and Mr. Arnott, of London, and by Dance and Tonnelle, of Paris. The pus generally resembles that of a phlegmonous abscess, and sometimes completely fills one or more of the larger veins of the womb and surrounding parts. In a case mentioned by Wilson,\* the uterine and iliac veins were greatly thickened, and the abdominal cava contained upwards of four ounces of purulent matter, which was prevented

\* *Transactions of a Society for the Improvement of Medical Knowledge*, vol. iii., p. 65.

from reaching the heart, partly by the contraction of the vessel near its entrance at the diaphragm, partly by a mass of pseudo-membrane. Suppuration is also liable to occur after venesection, amputation, compound fractures, and the application of the ligature. In the umbilical vein it often follows the tying of the cord, causing erysipelatous inflammation, which in a few days destroys life.

*Ulceration* of the veins occurs much less frequently than in the arteries. Commencing most commonly at one or more points of the inner membrane, it gradually extends to the other tunics, which it sometimes completely erodes. The immediate effect of this accident is an effusion of blood, which may be so great as to produce fatal results. The ulcers, which affect various forms, are occasionally quite numerous, and spread over a large extent of surface. Dr. Ribes, of Paris, has related a case in which nearly the whole of the lining membrane of the cephalic, median basilic, and radial veins, was studded with them, the other coats being at the same time much inflamed, thickened, and indurated.

The characters of *chronic inflammation* of the veins differ considerably from those of the acute form. The coats are usually much thickened, hypertrophied, and so dense that the vessel, when cut across, preserves its cylindrical figure, like an artery. The redness is of a brownish tint, interspersed with numerous shades of grey, violet, or purple; and the inner membrane, which is rough and shrivelled, can be easily raised in large opaque shreds. In some instances, the vein is dilated, or contracted, obstructed with clotted blood, lined by lymph, or filled with pus.

There are certain states of the system in which the veins seem to attain a very great size, carrying an inordinate amount of blood. This *hypertrophy*, for so it may be termed, is very conspicuous in chronic affections of the joints, in vascular and malignant tumors, and in the veins of the uterus during the latter months of pregnancy. It is always conjoined with hypertrophy of the arteries, and forms one of the most serious obstacles to the cure of various diseases.

*Dilatation* (Fig. 67) is most frequently observed in the veins of the testicles

and lower extremities, in persons whose employments compel them to stand for a long time in one position. It has also been observed in the superior extremities, and, in a few instances, I have witnessed it in the superficial veins of the abdomen. Of the deep-seated veins, those most frequently affected are the subclavian, jugular, azygos, and hemorrhoidal. The vessels, in this disease, become preternaturally large, elongated, knotty, irregular, and tortuous, winding in a serpentine manner underneath the skin. Their coats are either of the normal structure, or they are thick and rigid, or thin and expanded, or, finally, they are weak in some places, and hypertrophied in others. When laid open, they are found to be rough and irregularly sacculated, strong bands being sometimes stretched across their interior, which divide the vessel into little cells, filled with coagulated blood. The



Fig. 67.

valves, although they generally

retain their normal texture, are sometimes

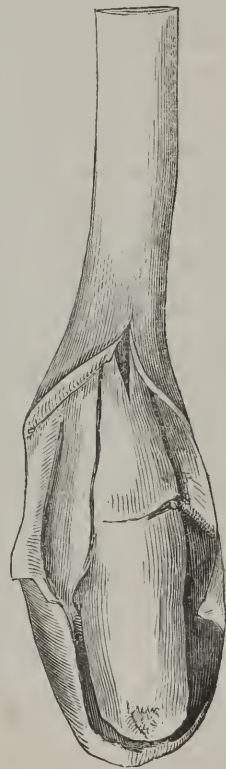


thickened, indurated, displaced, or ruptured. This varicose state of the veins is usually attended by chronic inflammation, and often leads to great and irreparable mischief. In many cases, the vessels are converted into hard, rigid cylinders, or their tunics are invaded by ulceration, followed by perforation and profuse hemorrhage.

Obliteration of the veins is by no means uncommon, and is almost always the result of inflammation. Sometimes it is caused by the pressure of a tumor forcing the sides of the vessel closely in contact, and so converting it into a dense, ligamentous cord. The largest veins are sometimes thus obliterated. Albinus. Baillie, Knappe, Pouchelt, and numerous other writers, have related cases where the great hollow veins themselves were either transformed into hard, fibrous cords, or obstructed by lymph, pus, clotted blood, polypous growths, or morbid deposits. A few years ago, along with Professor Drake and Dr. Rives, I examined the body of a man, aged forty, in whom the ascending cava was closed by a plug of plastic lymph, from the second lumbar vertebra as high up as the liver. The vessel retained its normal size, and the morbid substance, which was of a pale straw color, and of the consistence of semi-concrete albumen, adhered firmly to its inner surface, having evidently been deposited a long time previous to death. (Fig. 68.) A similar substance was found in the portal and right renal veins, together with several of the smaller veins of the left lung. All the abdominal viscera showed signs of chronic disease, and, during the last two years of his life, the individual suffered at intervals from ascites. In another case, which I saw eighteen months ago, a similar substance was found in the external iliac and femoral veins, together with some of the smaller vessels of the pelvis. The most prominent symptom here, as far as the veins were concerned, was œdema of the corresponding extremity.

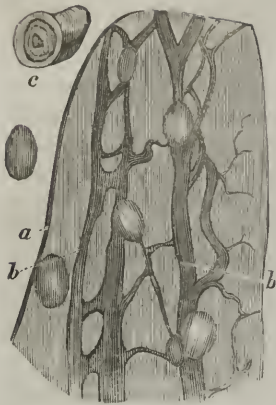
*Calcareous deposits* within the coats of the veins are much more rare than in those of the arteries, this circumstance depending upon their difference of organization. Instances of this, however, are recorded by various authors. Thus Morgagni and Baillie found patches of earthy matter in the walls of the great hollow vein of the abdomen; Saltzmann, Walter, and Beclard in the femoral vein; Macartney and Andral in the external saphenous. Whether the venous tissues are liable to the atheromatous degeneration, so common in the arterial, I am not prepared to say; probably they are not: at all events, I am not acquainted with a single instance of it on record, nor have I met with it in my own dissections. A sort of fatty substance is occasionally found. Andral once saw a tumor of this description, about the size of a walnut, which exhibited all the anatomical characters of the adipous texture. It was developed in the substance of the great portal vein, the cavity of which it almost filled.

Fig. 68.



Loose concretions, *phlebolites* (Fig. 69), or *vein-stones*, varying in size from

Fig. 69.



*a*, Broad ligament of uterus, *b b*, uterine veins containing phlebolites; *c*, phlebolite sawed open, exhibiting its concentric arrangement.

a currant to a pea, are occasionally found in the interior of these tubes. Commonly of a yellowish, brownish, or bluish color, they are of a hard and brittle consistence, and of an oblong, oval, or spherical form, with a smooth, even surface. When divided by the saw, they are found to be made up of several thin but distinct lamellae, disposed concentrically around a small delicate nucleus, frequently consisting of fibrin. The number of these calculi is extremely variable; rarely are there more than two or three, though occasionally as many as eight or ten have been observed. In a case examined by Tiedemann there were thirty-six. They are generally met with in the smaller veins; more frequently, perhaps, in the spermatic, uterine, vaginal, vesical, hemorrhoidal, and splenic, than in any other. According to the analysis of Gmelin, which has been recently confirmed by that of Dr. Prout, vein-stones are composed principally of phosphate and carbonate of lime, with a small amount of animal matter, probably albumen, and a trace of oxide of iron. A difference of opinion still prevails respecting their mode of origin. Some suppose that they are developed in the substance of the veins, from whence they make their way into their interior by destroying the lining membrane; others, on the contrary, believe that they are formed directly from the fibrous matter of the blood itself. The rounded shape and polished surface of these bodies, with the fact that the inner coat is often perfectly sound, strongly corroborate the latter conjecture. Cruveilhier has given a drawing of a number of phlebolites, which appear to have been developed in the very centre of fibrinous concretions; and every pathologist must have seen specimens in which he could clearly trace the progress, so to speak, of these new formations; some portions being of an earthy nature, others presenting all the characters of the plastic substance of the blood blended with more or less hematosine.

There is another topic upon which, in concluding this section, it will be necessary to make a few remarks, although it is one rather of a physiological than pathological nature. I allude to the fact that air thrown suddenly and in large quantity into the venous system is followed by fatal effects. This circumstance, although long ago known to Wepfer, Chabert, and other writers of the eighteenth century, appears to have been almost entirely forgotten, until it was again brought before the profession by the researches of Bichat, Nysten, Magendie, and Piedagnel. The experiments of these distinguished individuals clearly prove that the insufflation of air into the veins produces instantaneous death, and that, on dissection, traces of this fluid can be detected in different parts of the body, particularly in the right cavities of the heart. As an accidental occurrence, this effect is sometimes witnessed in surgical operations, involving the jugular, subclavian, or axillary veins, and as such it was first noticed by M. Beauchene, of Paris, in 1818, in cutting out a tumor from the neck of a young man. The dissection was nearly finished, when the patient suddenly became faint, and expired in forty-five minutes from the commencement of the operation. On examining the body, an aperture was found in the internal jugular vein, from which the air had evidently descended along the superior cava to the right chambers of the heart, thereby causing death. Since

that period, similar results have been observed by Dupuytren, Mott, Cooper, Warren, and other surgeons.

It is a singular fact, that the effects from this cause are much less violent, if the air be introduced gradually and in small quantity into the veins. The only difficulty, indeed, that is produced in this case is a momentary excitement of the action of the heart. If the insufflation, however, be repeated for several days, at intervals of six or eight hours, the powers of this organ will become very much weakened, and the pulmonary tissues so far deranged as to give rise to severe cough, frothy expectoration, and considerable embarrassment of the respiratory function. When the air is suddenly injected, the animal is instantly seized with partial syncope, utters cries expressive of suffering, and quickly expires. In the human subject, the accidental introduction of this fluid is sometimes attended with a peculiar hissing noise, like that which is heard when the air rushes into an exhausted receiver. In other cases, symptoms of apoplexy ensue: the countenance is of a livid complexion; the respiration deep and stertorous; the pulse slow, laborious, and almost imperceptible; the surface is bathed with cold perspiration, and the patient is perfectly insensible.

The question may be asked, in what manner does air, when introduced into the venous system, operate so as to produce these deleterious effects? This question, as might be anticipated, has been variously answered by different writers. By some it is maintained that the fluid acts principally, if not entirely, upon the brain, causing symptoms of violent congestion, loss of sensibility, and spasmodic rigidity of the muscles, — an explanation which is favored, in some degree, by the experiments of Nysten and Magendie, in which they induced apoplectic phenomena, by injecting air into the carotid arteries of animals. Others, on the contrary, believe that the primary obstacle is in the lungs, since these organs have been found in a condition similar to what is observed in asphyxia. Piedagnel and Leroy, from having seen these structures in a lacerated and emphysematous state, suppose that death is caused solely by this lesion. But the grounds of these opinions are by no means conclusive; and we are at last compelled to resort to the explanation, long ago suggested by the French physiologists, that the fatal effects in question are the result of the sudden distension of the right cavities of the heart, whereby the powers of that viscus are partially paralyzed, and the circulation materially impeded. This view is strongly corroborated, in the first place, by the fact, already adverted to, that, if the air be introduced into the veins in a slow and gradual manner, little or no functional derangement will manifest itself in either of the above organs; secondly, by the almost total failure of the pulse in cases of an opposite description; thirdly, by the remarkable insensibility of the patient; and, fourthly, by the circumstance that the foreign fluid is usually found in greatest abundance in the right chambers of the heart.

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## CHAPTER VII.

### OF THE LYMPHATICS.

Organization. — Liability to Inflammation and Suppuration. — Tubercular Deposits. — Dilatation. — Aneurism of the Thoracic Duct. — Situation and Structure of the Lymphatic Ganglions. — Lesions. — Inflammation and its ordinary consequences. — Hypertrophy. — Encephaloid Disease. — Tubercle. — Ossification. — Melanosis.

THE lymphatic vessels, closely connected to the surrounding parts by cellular tissue, are composed each of two tunics, an external and an internal. The



first, which may be likened to the middle membrane of the arteries and veins, is highly elastic, firm, and resisting, of a white greyish color, and that upon which the tubes mainly depend for their strength and support. Muscular fibres have been supposed to exist in this coat, but this idea is solely conjectural. The internal tunic, which is continuous with that of the veins, but more soft and extensible, is extremely thin, diaphanous, of a serous character, and yields readily in all directions. It presents a large number of short, semi-lunar folds (Fig. 70), technically called valves, which give rise to the knotted appearance of these vessels, and which usually occur in pairs, being attached, as in the venous system, by their convex edges. These two membranes are bound together by delicate cellular tissue, and furnished with appropriate arteries and veins. No nerves have yet been detected in them, though we may reasonably infer their presence, inasmuch as both the right and left thoracic ducts, the common centres of the lymphatics, are surrounded each by a nervous plexus.

Fig. 70.



It has just been intimated that all the absorbents converge towards two principal trunks, called the right and left thoracic ducts. The first of these, situated on the right side of the upper dorsal vertebræ, is formed by the confluence of the lymphatics of the right side of the head, neck, right upper extremity, and some of those of the chest: the other, which is about three lines in diameter, and consequently the largest vessel of the kind in the body, is stretched along the left side of the spinal column, and receives not only the absorbents of the lower extremities, the abdomen, and the chest, but likewise those of the left side of the head, neck, and left upper extremity. Both these trunks open respectively into the right and left subclavian veins, near their junction with the internal jugulars, thus pouring their contents into the current of blood flowing towards the right auricle of the heart.

As the lymphatics are so extremely delicate, it is by no means easy to detect in them those various alterations of structure to which they are liable. The following remarks, therefore, embracing a rapid outline of the principal lesions of this system of vessels, will have special reference to the left thoracic duct, in which it is alone possible, in the generality of cases, to detect any deviation from the normal standard.

Bichat long ago affirmed that the lymphatics are much more frequently affected with *inflammation* than the veins, an opinion which has been amply corroborated by the observations of more recent writers. In the early stage of the disease, the lining membrane is of a light reddish tint, opaque, slightly thickened, and preternaturally dense, yet so friable as to allow itself to be peeled off readily in small pellicles. As in the veins, the discoloration occurs at first in minute, circumscribed patches; after some time, however, it becomes uniform, deeper, and gradually invades the other tunic, the vessels of which, very much injected, may be seen ramifying in every direction, forming a network so delicate as to render it difficult to distinguish it with the naked eye. Flakes of lymph are sometimes found adhering to the inner surface; and, in violent cases, it may even be bathed with pus. Under these circumstances, both tunics are of a deep red, violet or purplish color, soft, and spongy, and the surrounding cellular tissue is swollen and infiltrated with serous and other fluids. The proper nutrient vessels, also, are excessively engorged with blood, and are no longer permeable to injecting matter.

When the superficial lymphatics are affected, they can be easily traced un-

derneath the skin, like small red cords, tense, nodulated, and painful to the touch, accompanying the principal veins, and going as far as the first conglomerate glands, — rarely beyond them. This appearance, which is well seen in dissecting wounds, in punctures, and in poisonous wounds, is often attended with considerable swelling and œdema of the connecting cellular texture.

Such is a succinct outline of the anatomical features of acute inflammation of the lymphatics. Of those which mark the chronic form of the disease, nothing need be said in this place, as they have not been properly investigated. That they are very analogous to those characterizing chronic inflammation of the veins, is highly probable; at least, such must be our conclusion, when we reflect upon the similarity of structure and function of these two systems of vessels.

It has been already stated that *suppuration* sometimes takes place in these vessels, and it may now be added, that they occasionally contain pus, the result obviously of absorption. Mascagni tells us that it is by no means uncommon to find purulent matter in the pulmonary lymphatics in phthisical subjects; and Velpeau and others have repeatedly seen the same thing in those of the womb and inferior extremities in women who died of phlegmasia dolens; It is still undecided, whether acute inflammation ever terminates in gangrene; but there is reason to believe that such an event is not only extremely rare, but that it never occurs as an idiopathic affection.

Andral has often seen *tubercular* matter in the lymphatics. In a woman who died of cancer of the uterus, in the Charity Hospital at Paris, he found the thoracic duct literally filled with this substance; in another case, besides being present in this reservoir, he noticed it in the absorbents of the lungs, the groin, and pelvis. Similar appearances have been witnessed by others.

Walther has seen these vessels *ossified* and of stony hardness; but this morbid change is much less common than in the arteries, and has only been observed in a few instances. More frequently they contain calcareous, chalky or bony matter; of this latter, examples are narrated by Scherl, Assalini, Lauth, and Poncy.

A remarkable *dilatation* of the lymphatics is sometimes observed, giving them a tortuous, varicose arrangement. (Fig. 71.) This lesion is well illustrated by a case mentioned by Carswell.

The subject of it was a young man, twenty-six years of age, who died with two swellings, — one in each groin, nearly as large as an orange, for which he had worn a double truss from his boyhood, under the supposition that they were of a hernial character. On examining the patient after death, the tumors were found to consist of an enormous dilatation of the lymphatics of the inguinal glands. When cut into, instead of presenting a solid, compact structure, they had the appearance of a coarse sponge, — the size of all these vessels being augmented, most of them from one to three lines in diameter. The same phenomenon was seen, only more strikingly, in the absorbents of the pelvic and lumbar regions. None of them were less than two, and many of them from three to four lines in diameter, whilst the thoracic duct itself was fully three times the natural di-



Fig. 71.

mensions. Sæmmering has seen the lymphatics of the intestines varicose in hernia; and the same condition was witnessed by Bichat in those of the serous membranes in dropsy.

Dr. Albers, of Bonn, has recently reported a case of what he terms *aneurism* of the thoracic duct. The patient, a man fifty-one years old, died of abscess of the liver. On examining the body after death, a knotty, elastic tumor was found, about the size and shape of a fig, and resembling very much a hydatid. Its walls were preternaturally thick and firm, and, on cutting through them, a director could be easily passed up and down the canal, thus showing that it was connected with the duct in question. The swelling was filled with thin, flaky lymph, and its inner surface was perfectly smooth and uniform. Baille states that he has seen the thoracic duct varicose, and nearly as large as the subclavian vein.

The thoracic duct is sometimes *obliterated*. This may depend either upon a thickening of its tunics, upon the presence of a foreign body, or upon the reciprocal adhesion of its valves, as in the interesting case narrated by Sir Astley Cooper.\* In whatever way produced, this occurrence almost always impairs the nutritive function, though, owing to the numerous anastomoses of these vessels, and to their continuation with the veins, this process is perhaps never entirely interrupted, the chyle finding its way along collateral channels, just as the blood does after the tying of an artery.

The other portion of this system consists of small, flattened bodies, of an oval or rounded shape, which have been described by authors under the several names of absorbent glands, lymphatic ganglions, or kernels. (Fig. 72.) Varying in size from two to ten lines, they are of the average diameter of the third of an inch, of a light pink color, and situated in such places as abound in cellular tissue, particularly at the bends of the joints. At the groin they occur in great numbers, as well as at the arm-pit, the side of the neck, the posterior mediastinal cavity, and in the cellular tissue of the pelvis and mesentery. In several of these places they are connected in chains, or clusters.

Each absorbent gland consists of a peculiar parenchymatous substance, surrounded by a thin capsule, which is made up essentially of condensed cellular tissue. This envelope, which sends numerous processes into the structure of the gland, is abundantly supplied with blood, the vessels forming upon it a beautiful network, which is always deeply injected in persons dying from asphyxia. On making a section of one of these bodies, it is found to consist of a homogeneous, porous substance, soft and fleshy to the touch, the central portion of which is whiter and somewhat firmer than the exterior. This substance is composed mainly of absorbent vessels, remarkably convoluted, dilated into irregular cells, bound together by very delicate cellular tissue, and accompanied by a great number of the finest arterial and venous capillaries.

Thus constituted, these glands are liable to inflammation, suppuration, gangrene, hypertrophy, carcinoma, tubercles, melanosis, and ossification.

In *acute inflammation*, the lymphatic glands are, at first, of a pale flesh color, hard and dense to the touch, considerably swollen, and cannot be torn with the same facility as in the normal state. When cut into, numerous minute

Fig. 72.



A lymphatic ganglion, with lymphatics running to and from it.

\* London Medical Records and Researches, vol. i., p. 28, 1798.



points, of a brownish tint, and evidently the orifices of divided absorbents, may be observed; and, in many instances, blood is extravasated into the connecting cellular tissue, in circumscribed specks, not larger, frequently, than the head of a small pin. The covering of the glands, of a light reddish hue, is every where crowded with injected vessels, radiating in beautiful, dendritic lines. At a more advanced period, these bodies acquire a dark violet color, become soft and spongy, from the infiltration of thin bloody matter, and, on being torn, their substance looks very much like that of the spleen.

In this affection, ganglions, naturally not larger than the kernel of an almond, may acquire the magnitude of an orange, or even of the fist; as is exemplified in cases of buboes, and in lymphatic swellings in the axilla, or about the neck. The tumefaction arises, apparently, from the internal connecting cellular tissue, or from thickening of the external coat of the absorbents, as these tubes are still pervious to mercurial injection. This disease may affect a single gland, extend to several, or involve a whole chain or group.

Maceration in water for a few days in hot weather deprives the inflamed ganglion completely of its red color, and converts it into a soft, greyish mass, which easily yields to the pressure of the finger. Boiling has the effect, at first, of rendering it dense and slightly elastic, — afterwards, friable and granular.

This disease occasionally terminates in *suppuration*, the period at which this event happens varying from a few days to a fortnight. The pus may be either diffused through the proper parenchymatous structure, converting it into a dirty, greyish mass, or it may be disseminated in distinct globules, or, finally, be collected into an abscess, which may be so large as to occupy the whole gland, the only thing that remains being its external envelope. The quantity of matter is sometimes very great; and, in the majority of cases, it is of a thin, greenish character, intermixed with hard, cheesy flakes. The glands most liable to suppuration are those of the groin, axilla, neck, and jaw.

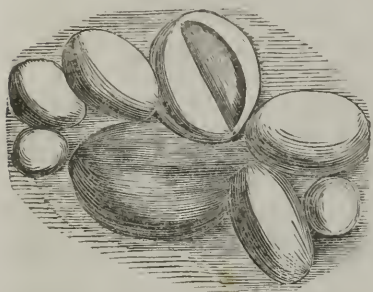
Acute inflammation sometimes ends in *gangrene*. When this takes place, the substance of the gland is of a dirty, greyish color, soft, pulpy, and bathed in a foul, fetid sanies, occasionally so acrid as to prove highly irritating to the surrounding parts. This termination of acute inflammation is well exemplified in cases of syphilitic buboes, occurring in debauched and worn-out habits. In such patients, immense sloughs are sometimes formed, the gangrene gradually spreading from the affected glands of the groin to the adjacent textures.

In *chronic inflammation*, the lymphatic ganglions are hard, firm, not easily lacerated, and of a light brownish color, interspersed with streaks and specks of grey, which have the effect of giving them a mottled aspect: their substance is infiltrated with lymph; and, on being cut, they slightly creak under the knife, the section presenting a homogeneous aspect. The fibrous envelope is very dense and thick; and both its own vessels and those which are distributed to the proper parenchymatous tissue are tortuous, knotty, and dilated. The absorbents entering into the composition of these bodies are also more or less enlarged, though, occasionally, their cavity is so much diminished as to render it impossible to inject them. The disease sometimes passes into suppuration, the parenchymatous structure being entirely destroyed, the thickened and indurated capsule being the only part that is left. The pus in such cases is semi-concrete, and often remarkably offensive, apparently from its long sojourn in the parts.

Chronic inflammation leaves these glands sometimes in a state of *hypertrophy*, as in Fig. 73. In this condition, they may be perfectly white or greyish, or else they may acquire a light brownish or yellowish tint; their con-

sistence, also, is frequently much augmented, and cases occasionally occur in which they are of a dense, gristly hardness, like *scirrhus*. The glands most liable to be thus affected are the mesenteric, bronchial, internal iliac, inguinal, and cervical. I have a prepara-

Fig 73.



tion, taken from a child three years of age, in which the mesenteric ganglions, all matted into one general mass much larger than a fœtal head, are of a bluish grey color, homogeneous, and of the consistence of cartilage, each one grating sensibly under the knife. Many of them are as large as an orange, and they all have a very thick, indurated capsule, of the same tint very much as the altered parenchymatous substance.

Hypertrophy of the lymphatic glands may arise from irritation, seated originally in their own tissue, or it may proceed from irritation propagated to them from the surrounding parts. In the glands of the mesentery, it is commonly caused by irritation of the bowels, especially of the ileum; in the groin, by that of the penis; in the axilla, by that of the breast; in the neck, by exposure to cold; at the jaw, by disease of the gums, teeth, or tonsils. Great mischief is sometimes occasioned by this morbid development. Cruickshank gives an instance in which the bronchial glands were affected to such an extent as to induce fatal suffocation; and Dr. William Hunter mentions that he has seen the internal iliac glands so much augmented as to cause death by preventing the descent of the child's head during parturition. When those of the mesentery are enlarged they may obstruct nutrition, and produce excessive emaciation, followed at length by loss of life. At the jaw, they sometimes produce permanent anchylosis; and at the transverse fissure of the liver, an enlarged lymphatic ganglion has been known, more than once, to cause jaundice, by compressing the hepatic or choledoch duct. Such are a few of the effects which may result from hypertrophy of these bodies, however induced.

It has been already mentioned that the lymphatic ganglions sometimes acquire the hardness and density of *scirrhus*, and it may now be added that they occasionally contain *encephaloid*. When thus affected, they are metamorphosed into a soft, brain-like substance, enclosed by a strong membranous cyst, with irregular fibrous filaments intersecting it in different directions. Grumous matter is sometimes found in such tumors, and now and then one part is medullary, another fibrous, another *scirrhus*. Serous cysts are also occasionally seen. In a case of *encephaloid* of the axillary ganglions, which I observed in a man fifty-six years of age, there was a single cavity of this kind which fluctuated under the finger, and contained upwards of eight ounces of sero-sanguinolent fluid.

Cattle are sometimes affected with *scirrhus* of the absorbent glands, especially such as live in low and damp situations. Cows are more particularly liable to it, and hitherto the disease has been observed chiefly in the glands of the mesentery. Mr. Brown, an English veterinary surgeon, has recorded a singular case, where a body of this kind weighed one hundred and sixty pounds. It was of a very irregular form, and, on making a section of it, it was found to exhibit a bluish, *scirrhus* appearance.\*

\* Youatt's British Cattle, p. 472.

*Tubercles* are frequently observed in the lymphatic glands, occurring either in small isolated granules, in considerable clusters, or in the form of infiltration. They are generally associated with tubercles of the lungs, and are most common in children between the ages of three and ten. Louis considers this morbid change as peculiar to phthisis; and he even goes so far as to affirm that it never exists, after the fifteenth year, without pulmonary consumption. This sweeping assertion has been contradicted by Broussais. It is certainly at variance with my own, and the experience of our best writers. It is but recently that I examined the body of a man, aged thirty, who died of psoas abscess, in whom, although the lungs were perfectly sound, the lumbar, pelvic, and mesenteric glands were most extensively tuberculized. Nor is this the only instance which I have seen of this disease unconnected with pulmonary phthisis.

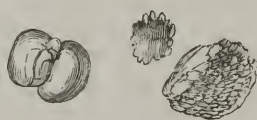
The deposition of tubercular matter is much more common in the bronchial glands than in any other. In one hundred children, in which these organs were carefully inspected, Dr. Lombard found them affected in eighty-seven. Age seems to exert a considerable influence in respect to the frequency of this deposition in different parts of the system. In adults, the mesenteric glands are more commonly affected. In one hundred phthisical subjects, Louis found these bodies tuberculized in twenty-three, or in the proportion nearly of one to four. When suffering under this disease, the glands exhibit different appearances, according to the progress it may have made. Generally speaking, they are enlarged in their size, of a dense gristly texture, white externally, and of a light rosy tint internally, either uniformly, in streaks, or in patches. The tubercular matter itself is of a singularly yellowish color, especially if it has existed for some length of time, and often contains particles of curdy pus.

The lymphatic glands are occasionally *ossified*, as in Fig. 74, and still more frequently they are transformed into a soft, whitish substance, like chalk. These changes most commonly occur in persons cut off by pulmonary phthisis, in the conglobate glands at the root of the lungs; but sometimes they are witnessed in other situations, as in the groin, the mesentery, and pelvis. Not long ago, I met with a case in which a considerable number of the absorbent glands of the neck were ossified. They were perfectly hard, like bone, of a light brownish color, irregularly rounded, and varied in size from that of a pea to that of a hazelnut. Occasionally the lesion seems to be confined entirely to the celulo-fibrous envelope of these bodies, their parenchymatous structure either remaining sound, or else containing tubercular or calcareous matter. In the bronchial glands, it is not unusual to find hard sabulous concretions, matted together by cellular tissue; similar substances, only of a more regular shape, I have several times seen in the lumbar and pelvic glands. In most of the cases which have come under my notice they were perfectly spherical, smooth, uniformly hard, and very few of them bigger than a currant; they occurred in the midst of the parenchymatous texture, to which they adhered by dense, cellular tissue, and which was, in other respects, entirely natural.

These morbid changes may be considered as resulting from a slow chronic inflammation, similar to that which accompanies ossific deposition in the arteries. Ordinarily, the metamorphosis begins at one or more points, from whence it gradually spreads in different directions, until it embraces the whole gland. When purely ossific, it is supposed by some to be preceded by cartilage, but this, I think, admits of much doubt.

Another morbid deposition which is sometimes noticed in these glands is

Fig. 74.





*melanosis*. Both Andral and Craigie state that this disease is very frequent in Europe, but that it is not so in this country is abundantly proved by the concurrent testimony of our most experienced writers. Excepting the bronchial glands, this deposition, indeed, is seldom witnessed in any other portion of the absorbent system. Such, at least, is the result of my own observation.

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## CHAPTER VIII.

### OF THE JOINTS.

#### SECTION I.

##### OF THE ARTICULAR CARTILAGES.

- I. *The Articular Cartilages*. — Structure and Chemical Composition. — Vascularity. — Lesions. — Reparation. — Inflammation. — Softening. — Suppuration. — Ulceration. — Ossification. — II. *The Synovial Membranes*. — Organization, Appearance, and Office. — Diseases: Inflammation—Effusion of Lymph and Pus—Ulceration—Chronic Irritation—Loose Cartilages — Chalky Concretions. — III. *The Ligaments*. — Structure and Sensibility. — Adhesive Inflammation. — Atrophy. — Calcareous Concretions.

THE articular extremities of the bones are incrustated with a thin, delicate lamella of cartilage, which adheres to them with so much firmness that it is impossible to separate it without the aid of protracted maceration in warm weather. Of the two surfaces which it presents, one is free, perfectly smooth, and covered throughout by synovial membrane; the other, on the contrary, is rough and mammillated, being studded with numerous little processes, which are received into corresponding osseous pits. In regard to its thickness, the lamella is subject to considerable variation; but it may be stated, as a general observation, that it is greater in the large than in the small joints: it is also greater in the convex articular surfaces at the centre than at the periphery; the reverse of which is the case in the concave. Of a pearly white color, it exhibits, when cut into layers, a semi-transparent, horny appearance, with a light cast of blue. Although seemingly homogeneous, this substance is found to be composed of small, delicate fibres, which are implanted perpendicularly to the surface of the bone, like the villi upon a piece of velvet, only infinitely more close and dense.

During embryotic existence, the articular cartilages exhibit the aspect and consistence of mucilage; but they gradually augment in density, until at length they acquire almost the hardness and solidity of the osseous tissue. In adult life, they are highly flexible and elastic; in decrepitude, on the contrary, they are dry, brittle, opaque, and sensibly attenuated.

These structures are easily cut with the knife. By boiling, they are rendered brittle, and are finally converted into a pulpy, tremulous mass. Exposed to the rays of the sun, or the dry heat of a fire, they assume a transparent, yellowish color; but, by immersing them in water for a few days, they gradually regain their former aspect. They resist, for a long time, the putrefactive process, and months elapse before they yield to maceration. According to the analysis of Dr. John Davy, of Edinburgh, the diarthroidal cartilages are composed of the following ingredients:

Albumen	-	-	-	-	-	-	-	44.5
Water	-	-	-	-	-	-	-	55.0
Phosphate of lime	-	-	-	-	-	-	-	.5
								<hr/> 100.0

The results of this experimentalist are somewhat different from those obtained by Allen and Gendrin, who, in addition to the substances already enumerated, detected a small proportion of carbonate of lime and gelatine. It is altogether probable that the chemical composition of cartilage, like that of bone, varies very much in the different periods of life. In children, there is generally a preponderance of animal matter, the quantity of which gradually diminishes in old age, being replaced partly by earthy substances.

In the immovable joints, the cartilages are arranged somewhat differently: they form very thin crusts, which are unprovided with synovial membrane, and which, in some of the articulations, are of a fibro-cartilaginous texture.

Are cartilages supplied with vessels and nerves? This is an interesting, and, in reference to the pathology of these textures, a highly important question. That cartilages are as highly endowed with vitality as some of the other parts of the body, is what no anatomist who has investigated the subject will assert; but that they are furnished with all the necessary ingredients of organization, has been abundantly demonstrated by observation and experiment. To deny that they are vascular, as has been done by some, is not less absurd than unphilosophical. Does it follow, because the naked eye is incapable of discerning the presence of vessels, that there must needs exist none? Who has ever demonstrated the vascular structure of the healthy cornea, the arachnoid tunic, or the synovial membranes? No one; and yet that these organs are highly organized every pathologist must admit, from his own observation. But analogy, in this case, I conceive to be, if not misapplied, at all events unnecessary. Repeated inspection of the cartilages of young animals, as well as of the human subject, has convinced me that these organs are infinitely more vascular than has been generally supposed. The vessels at this period are always large and well developed, carrying red fluid in every direction. In old age, they become less distinct, and many of them, no doubt, are obliterated. In inflammation of the joints, especially in the young, the vascularity of the cartilages, as will presently be shown, is not unfrequently quite conspicuous. In jaundice, I have repeatedly seen them of a light yellowish color, from the deposition of bile. No nerves have hitherto been traced into these bodies; but their existence is indicated, both by analogy, by the presence of vessels, and by the pain which they experience when laboring under disease.

Cartilages, both articular and non-articular, are susceptible of reparation, inflammation, suppuration, softening, ulceration, and ossification.

When divided by a sharp instrument, or torn asunder, as in fractures of the bones, cartilages readily unite, the edges of the wound being at first rounded off, and afterwards joined by a dense fibro-ligamentous substance, whiter and more opaque than the original structure. In some instances, the reparation is effected through the medium of osseous matter; but this is rather a rare occurrence. In this respect, the articular cartilages differ remarkably from the costal, which, when cut or broken, always unite by bony matter, the reparatory process being exactly analogous to that which nature employs in the cicatrization of a fracture. The difference in these two cases depends, no

doubt, upon some difference of structure, though it is by no means easy to determine why it is that an organ, which naturally contains less earthy matter than another, should, when injured, be more easily united by bone. The reverse, one might suppose, would be the more natural method. Is cartilage ever regenerated? Laennec and Beclard think it is; and careful observations, made since the time of those celebrated pathologists, fully authorize us in answering this question affirmatively. The reproduction, however, is generally very imperfect, and serves, therefore, as a very indifferent substitute for the original structure.

*Inflammation* of the cartilages may occur as a primary affection; but more generally succeeds to disease of the osseous, synovial, or ligamentous texture. Its progress is usually slow, and its characters are, for the most part, very obscure. In young persons there is sometimes a considerable degree of redness, the vessels of the joint being enlarged and continuous with those of the subjacent bone; but in old subjects this phenomenon is rarely present, the only evidence of the disease being a softened, spongy, and tumid condition of the cartilages. The inflammation is accompanied by severe pain, deep-seated, and of a dull, aching nature; and in a short time, if its course be not arrested, it is followed by ulceration or destructive mollescence.

*Softening* of the cartilages seems to be the result commonly of severe inflammatory action, by which their structure is converted into a semi-transparent, pulpy substance, not unlike thick starch. This change, which is sometimes effected with great rapidity, is generally connected with caries of the articular surfaces of the bones, and seems to be somewhat analogous in its character to gangrene of the soft parts.

Genuine *suppuration* of the movable cartilages is seldom if ever met with, the purulent matter which is found in the diarthroidal joints being generally poured out by the synovial or bony texture. In the pubic and sacro-iliac symphyses, pus has been seen by Ludovici, Hunter,\* and other writers; but the occurrence is extremely rare. Even in ulceration of this tissue, the formation of purulent fluid is by no means a constant accompaniment.

In gouty affections, the articular cartilages of the fingers and toes are often softened and either partially or entirely removed; similar effects are occasionally witnessed in scrofulous disorders of the spinal column, and of the joints of the hip and knee. During the latter stages of utero-gestation, the fibro-cartilaginous substance of the pubic symphysis is sometimes remarkably softened and relaxed, allowing the two contiguous bones to ride upon each other. A case of this kind came under my notice not long since. The lady was in her fifth pregnancy, and the separation, commencing about a month before her lying-in, was so great that she could scarcely walk, or turn in bed without the greatest suffering. The parts were almost as tender as a boil, and more than five weeks elapsed after her confinement before they regained their healthy character. This affection, which on the whole is rather uncommon in the human subject, seems to be natural to some of the inferior animals, as the

\* In a case related by this writer (*Medical Observations and Inquiries of London*, vol. ii., p. 321), at least an ounce and a half of pus were found in the pubic symphysis. It was confined in a distinct cavity, and the articular surfaces were separated fully an inch from each other: the cartilage on the right side was slightly eroded, but that on the other was perfectly smooth and sound: the periosteum was not materially affected, and the osseous tissue was quite sound. A small quantity of pus was also contained in the left hip-joint. The woman was in the twenty-sixth year of her age, and pregnant with her first child. The most prominent symptom was pain in the pubic region, commencing in the second month of gestation, and gradually augmenting in violence until it became excruciating, preventing exercise, and obliging her to lie entirely on her back.



rabbit and Guinea-pig, — its object, in them, being evidently to facilitate the parturient efforts. An analogous lesion is sometimes observed in the sacro-iliac junction ; but the softening and concomitant separation are always much less.

*Ulceration* of the cartilages, although it occasionally exists as a primary lesion, in most cases depends upon disease of the adjoining tissues, as caries of the extremities of the bones, or inflammation of the synovial membranes. It may take place at any period of life, or in any articulation ; but it is in the hip and knee that it is most generally met with, in persons between twenty and thirty years of age. In general the disease is confined to a single joint ; but occasionally two or three are affected in the same individual, either simultaneously, or in succession. Its causes are referable to local injury, atmospheric vicissitudes, or to a strumous, gouty, or syphilitic taint of the constitution.

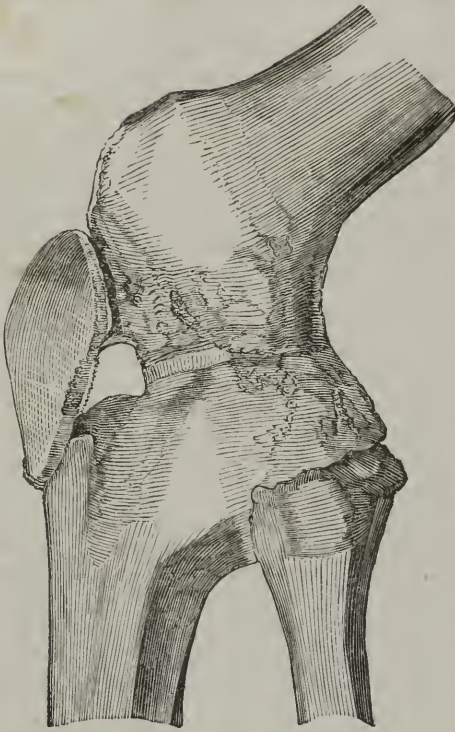
Ulcers of the cartilaginous tissue vary much in their size and form. Sometimes they are small and deep, like excavations ; more commonly, however, they are superficial, and occupy a pretty large extent of surface. In the primary variety of the disease, in which the erosion always begins towards the centre of the free surface of the cartilage, the ulcer is sometimes smooth, narrow, and of a light greyish color, as if a portion had been scooped out with a knife ; but more generally it is broad, irregular, and of a dull yellowish cast, involving a large amount of structure, and extending into the adjacent bone. The edges are often irregular, never elevated or undermined ; there are no vessels to be observed, no granulations, frequently no pus ; and the synovial membrane either retains its normal characters, or is vascular, opaque, and slightly thickened. The primary ulcer often spreads with great rapidity, producing complete denudation of the bones in the course of a few weeks. This is especially apt to occur in wounds of the large joints, attended with loss of substance, or the ingress of the atmosphere.

When the ulcers begin in the synovial membrane, or in the articular extremities of the bones, they are called *secondary*, and always possess certain traits by which they may be distinguished from the preceding. These differences, however, do not consist so much in anything that relates to the shape, size, or depth of these ulcers, as in the changes which are wrought in the adjoining structures. When the disease depends upon inflammation of the synovial texture, it commonly commences at the circumference of the cartilage, from which it slowly extends towards the centre of the articulation, destroying, as it proceeds, the lining membrane. Should the ulceration, on the other hand, have its origin in the bone, the cartilage will be gradually detached from its connection, partially absorbed, or broken down into a soft, pulpy, gelatinous, or lardaceous mass. This form of the disease is commonly associated with a strumous diathesis, and is most apt to occur in young children in the ilio-femoral articulation.

There is a singular condition of the diarthrodial cartilages, which is considered by Sir Benjamin Brodie as being pretty constantly produced by incipient ulceration. I allude to the peculiar fibrous condition in which the free surface of these bodies is sometimes found. The cartilage seems to be denuded of synovial membrane, and is every where studded with villousities, spicules, or bristles. The affection is most common in old people, and is probably caused by inflammation, attended with slow ulcerative action, or partial absorption.

Ulceration of the cartilages is always accompanied with severe pain, more

Fig. 75.



kind are preserved in the college museum. In two of these, the cartilaginous layers are entirely replaced by osseous matter, which has connected the contiguous bones into one common mass. (Fig. 75.)

or less tumefaction, and tenderness on pressure. Every motion of the joint causes uneasiness; the patient limps in walking, and is unable to exert himself with his accustomed freedom. After some time, the pain becomes more constant and annoying; there is great constitutional irritation, with loss of appetite and sleep; and the joint is permanently flexed, or completely disqualified from performing its proper functions. By degrees, matter collects in the articulation, the skin around it ulcerates, and the patient finally falls a victim to hectic fever.

The cartilages sometimes *ossify*, especially in persons far advanced in life. In the diarthrodial joints this event is rather uncommon, and is witnessed chiefly in disease of the spine, the hip, and knee. In these situations, the cartilages become not only bony, but are sometimes converted into a substance similar to ivory. The most frequent seat of ossification is the sacro-iliac junction, which is so often affected in adults that it is regarded by many as a natural occurrence. Several specimens of this

## SECTION II.

### OF THE SYNOVIAL MEMBRANE.

Besides the structures already enumerated as entering into the composition of the diarthrodial joints, there is another class which are known, from the fluid which they secrete, under the name of the synovial membranes. These textures, like the serous membranes of the splanchnic cavities, to which they bear the closest resemblance, are every where arranged in the form of shut sacs, which are reflected, on the one hand, over the articular cartilages, and, on the other, over the articular ligaments, to both of which they adhere with extreme tenacity.\* Their connection with the central portions of the diarthrodial car-

\* In some of the larger articulations, as in that of the hip and knee, loose folds are to be seen, analogous to those of the serous sac of the abdomen. They are formed by the duplicatures of the synovial membranes, and usually contain small masses of fat, which were formerly supposed, but erroneously, to be true secretory glands.

tilages, indeed, is so firm and obscure, that several able anatomists have been induced to deny altogether their existence in this situation. This opinion, however, is by no means correct, as I am convinced from a number of experiments that I have performed with a view of satisfying myself respecting this much-disputed and interesting point. By macerating the cartilages of the hip, knee, or shoulder-joint, for several weeks, or by subjecting them, for a short time, to boiling water, or the action of dilute acid, I have almost invariably been able to detect these membranes, and to raise portions of them with the forceps. But independently of their easy demonstrability, the existence of these structures is often rendered evident in certain pathological states of the joints, not only indeed, merely at the circumference, but at the very centre of their cartilaginous facings.

The synovial membranes have a whitish, semi-transparent aspect, are extremely soft and delicate, and appear to be merely a modification of the cellular element. Their external surface is closely attached, as we have already seen, to the surrounding textures; the internal, on the contrary, is free, smooth, and constantly lubricated, resembling, in this respect, the free surface of the pleura and peritonæum. No nerves can be traced into their substance; and their vessels, which do not naturally convey red blood, can only be seen when they are in a state of inflammation. Their vital properties are also very obscure.

The free surface of these membranes is constantly bedewed with a yellowish, transparent fluid, of a saline taste, and of a thick, viscid consistence. It is remarkably soft and unctuous to the touch, and is therefore admirably calculated for the office which nature has intended it to perform: heat partially coagulates it, and it readily mixes with water. From the analysis of Dr. John Davy, it appears that one hundred parts of synovia consists of

Water	-	-	-	-	-	98.03
Gelatine	-	-	-	-	-	.93
Albumen	-	-	-	-	-	.53
Muriate of soda	-	-	-	-	-	.23
						<hr/>
						99.72

In addition to these ingredients, Dr. Davy also detected a small proportion of fixed alkali, and traces of phosphate of lime.

As there are no glands connected with these membranes, it is obvious that the fluid, the physical and physiological properties of which we have just described, must be immediately derived from the vessels which are distributed through their substance. Its quantity varies in the different joints; for, whilst in some it can scarcely be said to exist in an appreciable manner, in others, as in the hip and knee, there is always, comparatively speaking, quite an abundance of it.

Synovial membrane readily unites when torn or divided, and is highly susceptible of inflammation.

All the joints are liable to inflammation of their lining membrane, but that of the knee is perhaps more frequently affected than all the others together. The disease is most apt to occur when the body has attained its full vigor, and may be produced by a great variety of causes, such as external violence, cold, the long-continued use of mercury, gout, rheumatism, or syphilis. The anatomical characters of acute synovitis are, redness, opacity, thickening, and diminished density of the affected membrane, with alteration of secretion, and infiltration of the surrounding cellular substance.



In the early stage of the disease, the redness is commonly very slight, the capillaries being disposed in delicate lines, separated by large intervals. After some time, however, the vessels assume an arborescent form, and the color becomes more intense, occurring either in a uniform manner, or in minute patches, resembling so many ecchymoses. As these changes proceed, the membrane loses its smoothness and transparency, augments slightly in thickness, and becomes so soft that it may be easily scraped off with the finger-nail, or the edge of the scalpel. The natural secretion, which is at first increased in quantity, thin and limpid, is soon rendered thick and turbid, and often contains flakes of lymph. At a more advanced stage, the secretion is entirely changed in its character, being puriform, sero-sanguinolent, or even purulent. Occasionally clots of pure blood are contained in the joint; and, in many instances, the free surface of the membrane is covered with minute shreds and globules of lymph, which have the effect of giving it a rough, tomentous aspect. The surrounding cellular tissue is distended with serum, and the vessels penetrating it are engorged with blood, which is so firmly impacted into them that it cannot be easily forced out.

The quantity of lymph thrown out in this disease is sometimes very great, filling up nearly the whole of the affected joint. It is generally of a pale straw color, greyish, or lilac, and often adheres very intimately to the inner surface of the articulation, being spread out in the form of an adventitious membrane. I do not know that vessels have ever been traced into this substance, but that it is susceptible of organization is fully established.

*Suppuration* of the synovial membranes is very apt to take place in scrofulous persons, and in such, the matter is generally of a thick, flaky character, like that of a psoas abscess. In most cases, the pus is remarkably viscid and ropy, owing to the admixture of synovial fluid, and not unfrequently it is of a dark grumous appearance, and more or less offensive. When the accumulation is small, it is sometimes absorbed, but more commonly it works its way out through the joint by the ulcerative process, and destroys the patient by constitutional irritation.

The synovial membranes are liable to ulceration. This occurs particularly where they are reflected over the peripheral portions of the joints. The edges of the erosions are generally very thin, and their size seldom exceeds that of a ten cent piece. It is difficult to say, in these cases, whether this ulceration begins in the membrane itself, in the subjacent cellular tissue, or in the substance of the cartilage. However this may be, the latter of these textures is always sooner or later involved in the process, and in this way small superficial abrasions are often converted into deep cavities.

In *chronic synovitis*, in which the vascularity is much less than in the acute, the membrane often presents a remarkably dull, mottled appearance. Its substance is sometimes very much thickened, either by an effusion of sero-albuminous matter into its molecular texture, or by the formation of adventitious membranes; and not infrequently, especially in cases of long standing, it is converted into a soft pulpy mass, of a light brownish color, intersected by numerous whitish shreds. Cases occur in which the synovial membrane is covered with multitudes of small pendulous excrescences, something like melon-seeds, warts, or the epiploic appendages of the large intestine.

The movable joints are liable to the formation of *fibro-cartilaginous concretions*, similar to those occasionally found in the peritoneal and pleuritic cavities. In their size they vary from a mustard-seed to that of a small bean; but they may acquire the volume of a marble, an almond, and even the patella. Their number also varies. Commonly there is only one; occasionally, however,

there are three or four, and in some instances, as those mentioned by Roberts, Haller, Morgagni, and Malgaigne, there may be as many as eighteen, twenty, twenty-five, and even sixty. Generally of an oval shape, they are sometimes lenticular, spherical, or angular, concave on one side, and convex on the other. They have a whitish pearly appearance, are perfectly smooth and even polished, and consist either of a single mass, or of several lobules, connected together by dense gristly matter. They may be tough and striated, like the ligamentous tissue; but in a majority of cases they are distinctly fibro-cartilaginous. When very ancient, they have usually a bony nucleus at the centre. These bodies are invested by a reflection of the synovial membrane, beneath which they are developed, and to which they are originally attached by a slender pedicle, which is ultimately ruptured by the friction of the articular surfaces between which they are situated. The joints most liable to them are the ginglymoid, particularly of the knee, elbow, and lower jaw.

The diarthrodial joints are occasionally the seat of gouty concretions, which, from their color and softness, have received the name of *chalk-stones*. The true nature of these bodies was first discovered by Dr. Wollaston, in 1797, who proved that they are composed of urate of soda. More recently Dr. John Davy has detected, besides this substance, a peculiar fatty matter, phosphate and carbonate of lime, and a minute quantity of carbonate of magnesia. In an old man, whom I examined some years ago, I found these concretions in nearly all the principal joints of the body, in small amorphous masses, of a whitish color, and of a soft, unctuous consistence. Sometimes they are perfectly smooth and round; more commonly, however, they are rough and irregular, grooved or nodulated. In most cases they are small, though they have been observed of the size of an egg. These bodies are almost always connected with a gouty diathesis, and appear to be caused by chronic inflammation of the synovial texture.

In chronic inflammation, the fluid which is thrown out is either thin and glairy, sero-oleaginous or puriform, rarely purulent. The quantity varies from one to five ounces, and in some rare cases it has been known to amount to more than a quart. This affection, which is distinguished by the term "dropsy," is rarely attended with much pain or inconvenience.

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### SECTION III.

#### OF THE LIGAMENTS.

Two varieties of ligaments enter into the composition of the movable joints, the capsular and funicular; the former of which seem to partake a good deal of the character of the fibrous membranes, while the latter are always extremely dense, firm, resisting, and of a dull white argentine color. They possess only a very slender share of elasticity, and yield scarcely any when an effort is made to stretch them. Their supply of blood, which is furnished by the small arteries in their immediate vicinity, is extremely scanty; and, as yet, few anatomists have succeeded in tracing any nerves into them. By protracted maceration, these structures may be reduced into a soft, pultaceous, greyish mass, which can be almost entirely resolved into gelatine by boiling.

The sensibility of the ligaments is extremely obscure in the normal state, so

that they may be cut without the individual being conscious of it. In this respect, they resemble the other fibrous tissues; but differ from them in the excruciating pain which ensues when they are forcibly stretched or twisted. Their sensibility is also remarkably heightened under inflammatory irritation. They are entirely destitute of contractility; and, when injured, are seldom if ever repaired.

The diseases of the ligaments are few in number and infrequent in their occurrence, owing, no doubt, to their very imperfect vascular and nervous endowments. The most important morbid changes are inflammation, atrophy, gouty concretions, and lardaceous degeneration.

When a ligament is cut or lacerated, it readily unites by *adhesive inflammation*, the process being exactly analogous to that which occurs in the restoration of a fractured bone. The vessels of the part, becoming enlarged, throw out lymph, which forms a capsule round the divided extremities, and thus keeps them in contact. The same kind of matter is afterwards effused between the ends of the ligament; and, in proportion as this becomes organized, and assumes the properties of the original texture, the outer capsule, just referred to, is diminished, until at length it is wholly absorbed, leaving behind it merely a slight cicatrice.

Doubts have been expressed by some writers whether ligaments are susceptible of *inflammation*. That they are occasionally the primary seat of this disease, cannot be denied; that they become often affected secondarily, is equally certain. The dissections of Sir Benjamin Brodie and other distinguished pathologists have fully established the latter point; and, as respects the former, its existence is daily witnessed in gouty and syphilitic disorders of the joints. When laboring under inflammation, the ligaments generally give rise to the most severe suffering, aggravated during the night, and leading to great constitutional irritation. This is well exemplified in sprains, which are always among the most painful accidents. The physical properties of these textures do not seem to be much altered in the early stages of the inflammation: they retain their white argentine aspect, and here and there may be discovered a straggling capillary. Subsequently, they become more vascular, and their substance is infiltrated with serous, albuminous, or sero-sanguinolent fluid. If the disease continues its ravages, the ligament breaks down into a soft, lardaceous mass, containing white, silvery shreds, but no trace of vessels. No pus is secreted during these changes; indeed, it is doubtful whether this fluid is ever deposited by this species of tissue, however much it may be inflamed.

*Atrophy* of the ligaments is sometimes produced by the pressure of an aneurismal tumor, or other morbid growth; but it more commonly arises through disease of the surrounding textures. When the muscles of the shoulder or hip are paralysed, the capsular ligaments of those joints are not infrequently so much attenuated and relaxed as to allow the bones to slip out of their sockets, and this occasionally in a very short period. Similar phenomena are sometimes witnessed in the temporo-maxillary articulation, and in the joints of the fingers and thumb. In these situations, indeed, spontaneous dislocations, from atrophy of the ligaments, are by no means uncommon.

*Calcareous concretions*, of the same character as those which are deposited within the synovial sacs, are sometimes found in the ligaments. When this matter is very abundant, as it is apt to be in persons of a gouty diathesis, it has a tendency to fret and irritate the ligaments, and to render them highly sensitive, and liable to hypertrophy.



## CHAPTER IX.

## OF THE OSSEOUS SYSTEM.

## SECTION I.

## OF THE BONES.

I. *The Bones.* — Notions of the older Writers respecting their Organization. — Vessels and Nerves. Chemical Constitution. — Effects of Heat and Acids. — Classification. — Compact, Areolar, and Canalculated Textures. — Diseases of the Bones. — Reparation. — Inflammation. — Suppuration. — Ulceration. — Gangrene. — Softening. — Rachitis. — Fragility. — Hypertrophy. — Atrophy. — Hydatids. — Aneurism. — Carcinoma. — Melanosis. — Tubercle. — II. *The Periosteum.* — Its fibrous structure liable to the same kinds of Diseases as the fibrous Membranes generally. — Hypertrophy. — Ossification. — Is seldom, if ever, affected by the Heterologous Formations. — III. *The Medullary Membrane.* — Situation and Character. — Diseases few, but important.

THE notions of the older anatomists respecting the organization of the bones, were exceedingly vague and unphilosophical. Many classed them among what they called the bloodless structures; and not a few imagined that they were entirely destitute of vitality. More correct observation, however, whilst it has long since exposed the fallacy of this opinion, has fully demonstrated that the bones, like the other organs of the body, possess a great abundance of vessels, so that they grow, waste, and are repaired; and that their diseases differ in no respect, save in the tardiness of their progress, from those of the soft parts. Nerves and absorbents also exist in the osseous tissue, probably in vast numbers, though it is difficult, if not impossible, to demonstrate them by the usual processes.

The bones owe their importance in the economy to their mechanical properties: they are entirely passive in their character, forming so many solid pieces for the action of the muscles and their tendons; and hence, although they are furnished with vessels and nerves, they are destitute of that sensibility which forms so striking an attitude of the soft parts. It is owing to this circumstance, that, in the normal state, the osseous tissue may be sawed, rasped, cut, or even cauterized, without the slightest indication of pain. When this substance is laboring under disease, it always becomes highly sensitive, and often gives rise to the most excruciating suffering. Nothing, therefore, can afford a better proof of the vitality of the bones than this fact; for, although this property, as just mentioned, is quite obscure in their sound state, yet when morbidly affected, they are subject not only to inflammation, but likewise to suppuration, ulceration, and even gangrene, — thus showing, in the most conclusive manner, that they possess the same organization, only in a less degree, as the other parts of the body, of which they have too frequently been considered, if I may so express myself, as semi-dead appendages.

The vessels of the bones, which enter their surfaces at every point, may be demonstrated by injection, and a variety of other means, as sawing, cutting, and rasping. When they are filled with fine red matter, and steeped in dilute muriatic acid until the earthy matter is removed, they will become quite distinct, especially if the part so treated be afterwards immersed in oil of turpentine. The vessels of the bones undergo remarkable changes in consequence of age. In infancy and youth, they are not only comparatively larger, but they are also much more numerous than in the old and decrepid. These differences give rise to differences of color. In the young subject, the bones are of a bluish tint; in the adult, on the contrary, they are pale and almost white. In

death from drowning, they are always well injected and highly vascular ; in dropsical persons, they are generally remarkably blanched.

I have never succeeded in tracing any nerves into the bones, nor have others been more fortunate. Some of the French anatomists, it is true, pretend that they have occasionally followed branches of the fifth pair through the nutrient foramina ; but their dissections have not, I believe, been verified by subsequent investigations. As to myself, I have long been of the opinion that the nerves of the osseous tissue are conveyed to it through the medium of the arteries ; that they enter the same apertures, and that they are so completely concealed in their coats as to baffle all attempts at discovery. Whether this view is correct, future observation can alone determine ; it is certainly plausible, and strongly supported by analogy.

Although the osseous tissue has been submitted to analysis by a great number of distinguished chemists, yet the results which have been obtained are by no means so satisfactory as could be desired. According to Berzelius, one hundred parts of human bone consists of nearly thirty-three of gelatine, fifty-one of phosphate of lime, two of fluuate of lime, and eleven of carbonate of lime, together with a small quantity of phosphate of magnesia, soda, and chloride of sodium. Fourcroy and Vauquelin met with no fluuate of lime in their examinations, but detected some oxide of iron and manganese, silic, alumine, and phosphate of ammonia. The chemical composition of the osseous tissue varies considerably in the different stages of life, under different circumstances of health and disease, in different pieces of the skeleton, and even in different parts of the same bone. In infancy and childhood, the relative proportion of animal matter is at its maximum, the earthy at its minimum. In advanced age, from the great predominance of phosphate and carbonate of lime, the osseous tissue is remarkably brittle, and prone to fracture.

If a portion of bone be subjected to a charcoal fire, and the heat be gradually raised, it will be found to burn first with considerable flame, and to emit a disagreeable animal odor, and at length to become almost perfectly red. If it be now carefully removed, and permitted to cool in a slow and gradual manner, it will exhibit a white, chalk-like appearance, and be so light and brittle as to crumble on the slightest touch. In this operation, the animal substance is extracted by destructive decomposition, whilst the earthy matter remains almost entirely unchanged ; at the same time that the bone retains its mechanical figure, having merely lost a small portion of its weight. These results may also be obtained in a more or less perfect manner by long-continued boiling. A large part of the animal substance will thus be extracted, and furnish a solution, which, on cooling, gradually concretes into a tremulous jelly-like mass.

If, on the other hand, a bone be exposed for some days to the action of a solution of nitric, muriatic or sulphuric acid, the saline ingredients will be gradually withdrawn, whilst the organic part remains and becomes gradually soft, flexible, and elastic. When dried, it will be found to have lost a portion of its weight, which is in direct proportion to the quantity of earthy matter taken up by the acid ; yet it will be impossible to perceive that the least atom of its substance has been mechanically removed, or that its form and aspect have been in any wise altered.

In regard to their varieties of form, the bones may be divided into four classes, — the long, broad, short, and mixed. The first, which are situated in the extremities, form a series of broken columns, which increase in number, but diminish in size, as they recede from the trunk. Each piece consists of a body, which is cylindrical in some, triangular in others, and in nearly all a little curved, and of two heads, which are thick and expanded. But what

particularly distinguishes the long bones is the circumstance of their having an internal canal, which is usually of the same configuration with their shafts, and which is occupied, in their recent state, by the marrow and medullary membrane.

The broad bones assist in enclosing the cranial and pelvic cavities; they are irregular in their form, and have each two surfaces, one of which is generally convex, the other concave.

The short bones are arranged in groups, forming masses which combine mobility with solidity: they are characterized by an equality of length, breadth, and thickness, by which they may be readily distinguished from the other pieces of the skeleton.

In the fourth division are included those parts of the skeleton which combine the form and character of the other classes. They are situated chiefly in the cranium and chest, and consist of the occipital and temporal bones, the sphenoid and ethmoid, the ribs, the clavicle, and the sternum. The form of these pieces is too irregular to admit of any general description.

Although these different classes of bones all consist essentially of the same anatomical and chemical constituents, yet their texture is varied, not only in each division, but in different parts frequently of the same piece. The principal modifications of form of the osseous tissue are three, the compact, the areolar, and the canalculated. (Fig. 76.) The compact substance occurs, in a greater or less degree, in every bone in the skeleton; but it is in the long that it is more particularly conspicuous, especially in their bodies, where it forms a layer of great thickness, which gradually diminishes as it approaches the extremities. In its texture, this substance is so remarkably close as to render it impossible to detect any interstices with the naked eye. With the aid, however, of the microscope, we are enabled to discover numerous minute canals, which freely communicate with the canalculated and spongy structures, designed for the transmission of the capillary vessels of the periosteum. These apertures, the existence of which was first clearly demonstrated by Havers, an English anatomist, are found in great abundance throughout the whole skeleton, and their diameter varies, according to the recent measurements of Dr. Miescher, from the three to the eight-hundredth part of an inch. In the long bones, the canals are directed obliquely; in the broad, on the contrary, they run parallel with the external surface. In many places, they pursue a transverse course.

The compact texture appears to be made up of numerous concentric lamellæ, which are bound together by horizontal and oblique processes, and the thickness of which varies in different parts of the skeleton, from the fiftieth to the five-hundredth part of an inch. This arrangement, which is best seen with a microscope, can be satisfactorily displayed by exposing a bone for a long time to the weather, and by protracted maceration in water after it has been deprived of its earthy salts. It is also rendered perceptible occasionally, on a rough scale, in mortification of the osseous tissue.

The *areolar texture* is not so extensively disseminated as the compact;

Fig. 76.



Section of the femur, showing its structure and medullary cavity.



nevertheless, it occurs in nearly every part of the skeleton. It is particularly abundant and well marked in the short bones and in the extremities of the long, and evidently results from an interlacement of osseous filaments, prolonged inwards from the canaliculated structure. The cells which are thus formed vary extremely in regard to their size and shape in different parts of the bony system; but they all freely communicate with each other, as may be proved by pouring quicksilver into them. This spongy substance, whilst it contributes materially to the lightness of the skeleton, subserves the more important purpose of a reservoir for the medullary membrane, and a surface for the distribution of the blood-vessels.

The *canaliculated texture*, interposed between the compact and arcular, occurs in all parts of the skeleton, but is least evident in the broad pieces. It consists of an assemblage of small, tortuous tubes, of an irregularly cylindrical shape, nearly parallel with each other, and the sides of which are pierced with minute apertures. In the long bones they pursue a longitudinal direction; but, in the short, they run from one articular surface to the other. Many of these canals communicate together, and their office, like that of the canals of Havers, by which they are chiefly formed, is to afford passage to the blood-vessels, as they proceed from the compact to the less dense substance of the osseous system.

Bones, deprived of their earthy matter, exhibit a homogeneous appearance; but by prolonged maceration in water they may be resolved, as before stated, into different layers, each of which will be found, upon examination, to consist of a series of filaments, disposed in a longitudinal, oblique, or horizontal manner. By continuing this process, the filaments will gradually become soft and swollen, and at length present an arcular texture, similar to the subcutaneous cellular substance. It may reasonably be concluded, therefore, that this arcular texture is the nidus which receives the hard, calcareous, inorganic matter which imparts to the osseous tissue its firmness and characteristic properties.

Having premised this brief sketch concerning the organization of the osseous tissue, which seemed necessary to a more perfect comprehension of its diseases, let us proceed, in the next place, to consider its various lesions. Of these the most important are the following: inflammation, suppuration, ulceration, gangrene, softening, fragility, hypertrophy, atrophy, hydatids, aneurism, carcinoma, melanosis, and tubercle.

The *restoration* of a fractured bone is effected by adhesive inflammation, analogous, in many respects, to that of the soft parts. The changes which attend it, and which are among the most interesting in the whole range of pathological inquiry, may be referred to four stages, each of which will require separate notice. In the first stage, which extends over a period of about five days, the efforts of nature are altogether of a preparatory character, being limited to the absorption of the blood which was poured out at the moment of the accident. At the expiration of this time, or even before, inflammation sets in; that is, the soft structures around the fracture become hot and vascular, their vessels enlarged and deeply injected, and their cells infiltrated with thick, viscid lymph. The same substance is effused between and around the broken ends, as well as within the medullary canal, and in this manner all the injured parts are temporarily glued together. This substance, which is of a light pink color, and of a soft, gelatinous consistence, is what is named *callus*, the real nature of which was a source of so many disputes among the ancient pathologists. As the restorative process advances, bony matter is gradually deposited upon the surface of the medullary membrane, until at length a dense, solid plug is formed, which fills up the internal canal, and holds the fragments together. Whilst these changes are

going on in the interior, the matter which has been effused upon the surface of the broken pieces also experiences important alterations. At first, as was before intimated, it is perfectly soft and gelatinous; but by degrees it becomes firm and elastic, like cartilage, and finally assumes all the properties of real bone. This substance is termed the *provisional callus*. It completely encases the fragments, adhering firmly to their outer surface. The quantity of callus is always in direct proportion to the amount of injury; and hence it is usually greater in an oblique or comminuted fracture than in one that is transverse.

In the third stage, the broken bone itself becomes sensibly changed; the lymph which was effused between the fragments, and which until now experienced little alteration, acquires consistence and firmness; numerous vessels are developed in it, and communicate with those of the surrounding structures; and at length, ossification being completed, the two ends of the broken bone are firmly reunited. The period required to effect these changes, is greatly influenced by the age and constitution of the patient, the plan of treatment, and the nature and seat of the fracture; in general, from six to eight weeks may be said to elapse between their commencement and completion.

In the fourth and last stage, embracing a period of several months, the provisional callus is gradually absorbed, the soft parts resume their natural state, the prominence formed by the new bone diminishes, and the internal osseous plug is wrought into cells and cavities, by which the medullary canal is at last completely re-established.

Thus it appears, as has been already hinted, that the process by which a broken bone is reunited is truly analogous to that which nature adopts in restoring wounds of the soft parts. The only difference seems to consist in the changes which occur in the surrounding parts, and in the formation of the provisional callus. But, in order to render this process effectual, it is necessary that the broken bone should be kept at rest, that it should be provided with a due amount of animal matter, and that the vascular connection between it and the adjacent structures should not be too much interrupted. If these conditions be absent, the restoration will be imperfect, or a false joint will be formed. Fractures of the neck of the thigh bone, the patella, and the olecranon, rarely unite by osseous matter, but in almost all cases through the medium of a white, fibro-ligamentous substance. The causes of this imperfect reproduction consist chiefly in a defect of periosteum, in inefficient nutrition, and in the difficulty which the surgeon experiences in maintaining the fragments in proper apposition. That the union of internal parts greatly depends upon the changes which take place in the surrounding textures, is a fact which has been abundantly verified by observation; and that false joints are often produced by bad and injudicious management is equally true. In the examples, then, before us, it may be supposed that these are the principal, if not the sole agents, which interfere with the restorative process. In the case of the neck of the thigh-bone, the influence of the periosteum, in the production of osseous matter, is strikingly illustrated by the fact, that, if the fracture be seated partly without and partly within the capsular ligament, the former will unite by bone, the latter by fibrous matter.

When a *false joint* is thus formed, the ends of the broken bone are gradually rounded off, and converted into a smooth, secreting surface, which secretes a thin, oily fluid, not unlike synovia. The surrounding cellular substance is at the same time condensed; and in this manner it is made at length to answer the purposes of a capsular ligament.

The newly-formed bone varies considerably in its properties according to the period at which it is examined. In recent cases it always contains a large quantity of animal matter, and is therefore comparatively soft; subsequently,

however, it is saturated with earthy salts, and increases greatly in density. In a fractured humerus, one hundred and twenty-eight days after the injury, Dr. Davy found the comparative composition of the shaft and callus to be as follows:

				Shaft.				Callus.
Animal matter	-	-	-	38.60	-	-	-	38.8
Earthy salts	-	-	-	61.40	-	-	-	61.2

From a specimen where the fracture had occurred long before death, and where the new structures approached the density of ivory, De Claubry obtained the subjoined results:

				Original bone.				Callus.
Animal matter	-	-	-	56.284	-	-	-	43.795
Carbonate of lime	-	-	-	3.846	-	-	-	9.785
Phosphate of lime	-	-	-	38.075	-	-	-	44.894
Phosphate of magnesia	-	-	-	1.012	-	-	-	1.526

The new matter is sometimes remarkably exuberant, as is seen in Fig. 77,

Fig. 77.



Fig. 78.



from specimen in the possession of my friend, Professor Cobb. The fracture, which was oblique, and seated just below the middle of the right femur, had



evidently occurred several years before death. The callus is exceedingly porous in its structure, very brittle, and eleven inches in circumference at the widest part, by six inches in length. From its upper extremity are detached two processes, which overlap the superior fragment, and must have considerably impeded the action of the muscles of the limb.

The more completely the ends of a broken bone are maintained in contact the more readily and perfectly, all other things being equal, will they be reunited. Osseous reparation, however, is not impossible even when the separation is unusually great. Fig. 78 is the humerus of a turkey, which had been broken near the middle. The union is formed by dense osseous matter, much stronger than the original texture. The distance between the fragments is nearly one inch. The specimen is in my private collection.

The changes which are wrought in the extremity of a bone after amputation are not without interest.

The edges are gradually rounded off by the action of the absorbents, and new matter is deposited by which the end is covered over, and the medullary canal, as it were, hermetically sealed. Fig. 79, from a specimen in my cabinet, affords a good illustration of these appearances. The bones, sawed off three inches and a half below the knee, are connected by a narrow ledge of matter, or a kind of exostosis, and coated with a thin osseous plate. In some instances the osseous stump is remarkably atrophied and reduced in size, probably from the constant pressure of the artificial leg.

Fig. 79.

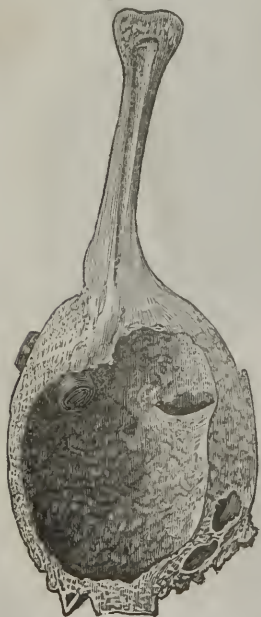


*Osteitis* was formerly supposed to be of very rare occurrence; there is reason to believe, however, that it is not only a frequent malady, but that it is present, in some form or other, in almost every affection of the osseous tissue, whether primary or secondary. The bones most commonly affected are those of the extremities, especially the tibia, which, from its exposed situation and consequent liability to injury, seems to be particularly prone to it. The inflammation may be primarily seated in the osseous structure, or it may be propagated to it from the soft parts: in either case, the periosteum and medullary membrane are apt, sooner or later, to become implicated in the disorder. The malady is generally slow in its progress, and hence a considerable period often elapses before there are any appreciable alterations of tissue. At first, the bone is simply enlarged; but, in a short time, it loses its density, becomes infiltrated with sero-sanguinolent fluid, and assumes a bright reddish hue, the capillaries

being very numerous, turgid, and distinct. As the disease advances, the osseous fibres separate from each other, and the widened intervals are filled with a soft gelatinous substance, mixed with which it is not unusual to find small clots of blood. These changes are generally attended by an absorption of earthy matter, which has the effect of rendering the bone soft and spongy, at the same time that it causes an actual diminution of weight. This, however, is not an invariable phenomenon, — cases occasionally occurring where the phosphate and carbonate of lime are deposited in inordinate quantity, by which the osseous tissue is made preternaturally brittle. When the inflammation is superficial, it usually extends, as was before remarked, to the periosteum, which becomes hot, red, and swollen, — in a word, manifests all the signs of ordinary inflammation. When the medullary membrane is implicated, it becomes bloodshot, and the adipous matter is either rapidly absorbed, or it is transformed into a soft diffuent mass, of a light reddish color, and of a peculiarly offensive odor. When the ossific inflammation is fully established, the engorged capillary vessels refuse to receive injecting matter, and can be drained of their contents only after protracted maceration. The pain attending this disease is commonly of a dull aching character, and is apt to be worse at night than in the day-time. When the periosteum is involved, it is more severe, — sometimes, indeed, almost intolerable.

Osteitis may terminate in resolution, suppuration, ulceration, or gangrene. *Suppuration* of the external substance of the bones is a very common occurrence; but, as it is ordinarily complicated with periostitis, it is difficult to determine which structure is the source of the purulent secretion. It is most frequently observed in connection with some constitutional taint, such as scrofula, syphilis, or the protracted use of mercury; but it may, and very often does, exist as a purely idiopathic disease. When suppuration takes place in the spongy texture of the bones, the pus is sometimes contained in a delicate,

Fig. 80.



vascular cyst, composed of coagulating lymph. Several such collections are occasionally found in a single bone. In a carious tibia which I inspected several years ago, there were three distinct abscesses in the upper extremity, the largest of which did not exceed a common almond, whilst the smallest was scarcely of the size of a pea. They were lined each by a soft, vascular membrane, and the bony texture in the neighborhood was unnaturally hard and white. The subject was a female, forty-five years old, who finally died of pulmonary phthisis. Abscesses of this kind seldom attain any considerable magnitude: their contents are dark-colored, thin, and offensive; and, if seated near the extremity of the bone, the matter usually manifests a tendency to work its way into the contiguous joint.

In abscess the bone is sometimes expanded into an immense shell, capable of holding several ounces, and constituting what was formerly called *spina ventosa*. Fig. 80 represents this appearance in a striking degree.

*Ulceration* of the osseous tissue is most generally met with in young persons, being rarely observed in the adult or very aged. The disease, which is usually known under the name of *caries*, is precisely

analogous to ulceration of the soft parts, the most prominent feature of each

being a loss of substance through absorption. It is always preceded, as well as accompanied, by inflammatory action, and may be owing either to local injury or to constitutional causes, such as syphilis, scurvy, scrofula, or deficient nutrition. It may also result from the pressure of aneurismal tumors, or from the spread of malignant ulcers in the soft parts.

Every part of the osseous system is liable to caries; but the pieces most frequently attacked are those which form the walls of the thorax and pelvis, the bones of the tarsus and carpus, the bones of the spine, and the heads of the cylindrical bones of the extremities, especially the lower.

Various attempts have been made to arrange caries into different species, the distinction being usually founded upon the appearances of the affected bone, or upon the nature of the exciting causes of the disease. Mr. Mayo, one of the most recent writers on the subject, states that there are four kinds of caries, — the simple, syphilitic, strumous, and malignant. The older writers had a still greater number, and every one, indeed, seems to have as many divisions as suits his particular fancy. Without wishing to substitute any classification of my own, I believe that, for all practical purposes, it will be sufficient to divide the disease into two species, — the superficial, and deep-seated; the one commencing in the compact, the other in the spongy structure.

Caries often goes on for a considerable period without there being any ulceration of the soft parts; and, in such cases, the diagnosis is usually extremely difficult. In the majority of instances, however, the nature of the complaint is indicated by the dull, aching pain, the tenderness on pressure, and the red, inflammatory state of the skin. After some time, the superincumbent parts become loose and boggy, and at length one or more apertures appear in them, through which is discharged a very fetid, dark-colored, or greyish sanies. The bone which is thus exposed has a foul and corroded aspect, its texture being softened, and infiltrated with a thin brownish fluid, mixed with blood, or with a yellowish, ropy substance, not unlike ill-elaborated pus. The ulcers may occupy quite a considerable extent of surface; but, in most cases, they are small, and of a rounded or oval shape. Their edges are steep, elevated, or abrupt, and their bottom is generally studded with small, osseous points, which have the effect of making it rough and irregular. The erosions have sometimes a very great depth, and in the broad bones it is not uncommon to see them involve both tables, giving them thus a singularly cribriform appearance. Occasionally they have a sinuous arrangement, the affected surface bearing a close resemblance to the bark of a worm-eaten tree. The osseous texture in the immediate neighborhood of these ulcers is always in a state of inflammation; and the same may be said of the periosteum, which is either red and thickened, greatly indurated,

Fig. 81.





or converted into fibro-cartilage. Cases occur, in which the osseous tissue, although slightly softened, is in reality very porous and brittle, owing to an inordinate deposition of earthy matter. This form of the disease, which seems to effect only the broad bones, is generally attended with little discharge, and hence the ancients were in the habit of calling it "dry caries." Fig. 81 is a good illustration of ulcerative perforation of the internal cuneiform bone of the left foot, which I was obliged to amputate on account of the great extent of the caries.

The matter which attends ulceration of the osseous tissue is commonly of a thin, watery, ichorous nature, highly irritating to the soft parts, and of an offensive odor. It always contains a large amount of earthy salts, on which account the instruments used in dressing a sore of this kind are usually stained black, especially if made of silver. When granulations sprout up, as is always the case when the ulcer manifests a disposition to heal, the matter becomes less acrid, more copious and consistent, and, as the recuperative process advances, it assumes all the properties of laudable pus.

There are few topics connected with the diseases of the bones which are more interesting than that of *gangrene*, whether we regard the facility and frequency of its occurrence, or the various phenomena which attend its progress and termination. The disease may show itself at any period; but, in the generality of cases, it comes on between the fifth and the twentieth year, seldom before, and still more rarely after. The parts of the osseous system most frequently affected are the tibia, clavicle, inferior maxilla, femur, ulna, radius, and fibula, though no bone in the body is, perhaps, entirely exempt from it.

Necrosis may be partial or entire, simple or compound; that is, it may affect merely a part of a bone, or it may pervade its whole structure; again, it may be limited to one bone, or it may attack several pieces simultaneously, or several different parts of the same bone. The causes of the complaint are either local or general, and are not essentially different from those which lead to *gangrene* in the soft textures. Among the local causes may be enumerated wounds, contusions, fractures, and chemical irritants; among the internal, a scrofulous or venereal taint of the system, the long-continued use of mercury, and the effects of protracted and debilitating febrile diseases. But a much more frequent source, perhaps, of necrosis than any other that I have yet mentioned, is exposure to cold. This, at least, seems to be the way in which children generally contract this disease in this country. A boy, for example, with his body perfectly heated, suddenly plunges into the cold water, and thus at once checks the perspiration. He retires to bed in good health; but, towards morning, he is roused from his slumbers by a severe pain in his tibia, clavicle, or radius. The skin next becomes flushed, the part is tender on pressure, and finally there is a circumscribed tumor, which, ulcerating, gives vent to a thin, sanious fluid, similar to that which attends caries. All these phenomena indicate that there has been osteitis; and, if the bone be carefully inspected, a considerable portion of it will be found to have perished. When thus induced, the complaint is often extremely rapid in its progress, and soon comes to a crisis.

It has been stated that necrosis is sometimes partial, or, in other words, limited to a part of a bone. In such cases, death usually arises from external causes, as a blow or contusion, or from denudation, and rarely extends beyond the outer compact structure. Exfoliation is not a necessary consequence of a bone that is stripped of its periosteum. If it be in other respects healthy, and enjoy a vigorous circulation, granulations will spring up and gradually repair the breach. If the denudation, however, be very extensive, even although the bone should be perfectly sound, exfoliation will be very apt to take place,

owing to the injury which has been inflicted upon the capillary vessels of the part. The exposed part, supposing that the disease has been occasioned by a removal of the periosteum, remains white and dry, and after some time *exfoliates*, or comes away in one or more thin scales, plates, or lamellæ. The surface from which the separation has been effected is covered with florid granulations, which by degrees assume the ossific process, and thus finally replace, in part or entirely, the lost substance. The exfoliated bone is either white, greyish, or of a light brownish color, rough, often very porous, and so brittle as to fall to pieces under the slightest pressure of the finger. No vessels can be perceived in it, and the animal matter seems to be almost wholly abstracted. By maceration, its dark color gradually disappears; and, by immersion in dilute nitric or muriatic acid for a few days, its texture is completely broken up, and converted into soft, gritty particles.

When necrosis pervades the whole thickness of a bone, as it is apt to do when it follows caries, exposure to cold, small-pox, or measles, the process of separation is much more complex and tedious, months often elapsing between the death of the part and its final exit from the body. The first step in the process is the formation of a sort of osseous shell, which seems to be designed to answer as a temporary substitute for the old bone, at the same time that it serves to isolate it from the surrounding parts. Let us inquire how this is effected; how an organ which has so greatly suffered is repaired? The dead bone acting as an irritant or an extraneous body, excites inflammation in the circumjacent structures, which become thickened and pour out coagulating lymph, similar to that which is effused around the extremities of a fracture. After some time, varying according to the age and vigor of the patient, this substance acquires the properties of cartilage, and this again, in its turn, is finally replaced by osseous matter, arranged in the form of an irregular shell, from one to three lines in thickness. In this shell one or more holes — sometimes as

Fig. 82.



Fig. 83.



many as eight or ten — technically termed *cloacæ*, and of a rounded or oval shape, are left, which communicate with the surface of the limb, and form the channels through which the dead bone, now named the *sequestrum*, is ultimately expelled. The period at which this takes place varies from six or eight weeks to ten or twelve months. The appearances here mentioned are shown in the preceding sketches. Fig. 82 is a necrosed tibia, in which the new osseous shell is perforated by *cloacæ* or holes, and encloses the old or dead bone. Fig 83 is a rather common form of sequestrum of the tibia ; the spongy structure is entirely destroyed, and the compact is remarkably hard and firm. The drawing is from a specimen presented to me by a former pupil, Dr. B. F. Shumard.

The sequestrum is of the same nature precisely as an eschar or slough of the soft parts. It is a dead or effete substance, which must be expelled by ulcerative absorption. As long as it is retained it produces more or less irritation in the parts with which it is in contact, and is bathed in thin, fœtid, sanious matter, or in thick, white, inodorous pus. Its surface is usually rough, excavated, spiculated, or honey-combed ; its color greyish, brownish or black. In the cylindrical bones it is almost always dense and dry ; in the short, porous, moist, brittle, and easily crumbled.

It has been generally supposed that the sequestrum, during its sojourn among the living tissues, is more or less diminished in size and weight by the agency of the absorbents. The recent experiments, however, of Mr. Gulliver, throw some doubt upon the correctness of this opinion, if, indeed, they do not entirely disprove it. Pieces of bone, carefully weighed before and after exposure, were confined on suppurating surfaces, inserted in the medullary canal, or worn as setons in the subcutaneous cellular tissue, and kept there for months, and in one instance for more than a year, without undergoing the slightest alteration in any respect. A paper, detailing nineteen experiments of this kind, is published in the twenty-first volume of the London Medico-Chirurgical Transactions.

As soon as the sequester is removed, whether by nature or by art, the temporary shell contracts, and by degrees assumes the form of the old bone which it is designed to replace. Whilst this change is going on externally, osseous matter is deposited upon the inner surface of the shell, and upon the extremities of the surviving portions ; and in this manner the vacant cavity is finally filled up, the time required being always in proportion to the size of the eschar. The medullary canal, in case there was one previously, is seldom re-established ; the new bone, although it remains for a long period highly vascular, is not able to withstand the effects of inflammation so well as the original.

Are bones ever completely regenerated ? Respecting this occurrence various opinions have been expressed by pathologists, some denying, others strenuously contending for the possibility of it. The question, it is obvious, can only be decided by observation ; and, if this be taken as our guide, few writers will be able to determine the matter for themselves. Here, as in many other obscure points in pathology, a candid appeal to facts, as they have been recorded by physicians, will do infinitely more than a thousand conjectures. The testimony of the older writers, unfortunately, is of little avail, as they were in the habit, too frequently, of distorting facts to suit their own theories. The same objection lies against some of the moderns ; still there are many exceptions, and from these we must draw our information. All parts of the skeleton do not seem to be equally capable of reproduction. The short



and broad bones are much more rarely regenerated than the long ; and among the latter the occurrence has been much oftener witnessed in the tibia than in any other of the cylindrical pieces. Moreau saw a case of complete regeneration of the clavicle ; Chopart, of the scapula ; Fowles, of the ulna ; and Weidemann, of the lower-jaw. In 1832, I had an opportunity of seeing an Irish lad, from whom Dr. Cusack, of Dublin, had, about four years previously, removed the left half of the inferior maxilla, on account of an osteo-sarcomatous affection. In this case, nature had made an attempt at reproduction, though it was still imperfect at the time I made the examination, the part being replaced by a thick, rounded piece of cartilage, sufficiently strong, however, to subserve the ordinary purposes of mastication. Not long ago, a young man showed me the upper half of his astragalus, which had sloughed away several years ago ; yet he had the perfect use of his ankle, which can only be explained on the ground of a perfect reproduction of the necrosed bone. At the time I saw him, the ulna of the left arm was in a state of gangrenous inflammation.

No doubt can therefore be entertained, it seems to me, respecting the possibility of bones being regenerated. For my own part, I am fully convinced of it, and feel assured that whoever will candidly investigate the subject will come to a similar conclusion. At the same time, there is reason to believe that the occurrence is extremely rare ; and no account should be received as true, unless it be vouched for by respectable authority.

The symptoms of necrosis do not differ, at first, materially from those of caries ; and the diagnosis can seldom be determined with any degree of certainty until there is a discharge of dark-colored splinters, or until some of the dead fragments protrude through the opening in the soft parts, or are visible on separating its edges. When these phenomena are present, there can be no doubt of the nature of the disease ; in cases of an opposite character, the diagnosis is sometimes extremely difficult. In such cases, a careful examination should be made with the index-finger ; or, where this is impracticable on account of the tortuous course of the sinuses, or the narrow state of the ulcerated orifices, a probe should be employed, with which the condition of the bone should be accurately ascertained.

*Softening* of the bones was first noticed as a distinct disease in 1688, by Gabriel. More frequent in the female than in the male sex, it occurs almost exclusively in adults, and has been known, in a few instances, to involve the whole skeleton. Of this, the woman Lussiot, whose case is described in the *Memoirs of the Royal Academy of Paris*, for 1752, affords a memorable example : her bones were so soft that they could be bent like wax, and put in almost any position. In a case described by the late Mr. Wilson, of London, the only pieces which escaped this disease were the sacrum and bones of the foot. More generally, the lesion is confined to particular bones, being especially apt to occur in such as are largely supplied with spongy matter.

The osseous tissue in this affection loses its firmness and consistence, becomes soft and pliant, and may be easily cut with the knife. It is of a pale reddish color, often inclining to yellow, is specifically lighter than the healthy structure, and is infiltrated with a turbid, viscid serum, removable by pressure. Occasionally, the osseous fibres are widely separated from each other, so as to leave large cells, which are filled with a bloody-looking, adipous substance. When this is the case, the bone is sometimes remarkably pliant, bending like semi-concrete wax. Boiling completely dissolves it ; and exposure to the air, by abstracting its moisture, diminishes its weight. Such are the principal

changes observable in the osseous tissue. The periosteum over the affected part is pale and extenuated; the marrow is converted into a reddish, greasy sanies; and the medullary membrane is wasted down to a few soft, cellular shreds.

The softening generally involves the whole thickness of the bone; but cases occur in which the outer table remains unchanged, consisting of a thin, brittle shell. The disorder obviously consists either in an inordinate absorption of the phosphate of lime, upon which the solidity of the osseous structure depends, or in a deficient deposition of this matter into its meshes. It has been already mentioned, that the bones become specifically lighter in this disease; and Dr. Bostock has ascertained the additional fact that they contain nearly eighty parts of animal substance in the hundred. The experiments of this gentleman have been recently confirmed by those of Dr. G. O. Rees, of London,\* who, from a careful analysis of three diseased specimens, taken from the same adult subject, obtained the following results; which he has compared with those furnished by healthy bones:

		Diseased		Healthy	
		Earths.	Animal matter.	Earths.	Animal matter.
Fibula	-	32·50	67·50	60·02	39·98
Rib	-	30·00	70·00	57·49	42·51
Vertebra	-	26·13	73·87	57·42	42·58

On examining this table, it will be observed that, in the diseased as well as in the sound state, the fibula contains more earthy matter than the rib, and the rib more than the vertebra. In health, the vertebra and rib approach very nearly in their proportions of animal and saline ingredients, while in softening a considerable difference exists between them in this respect. The causes of this change are buried in entire obscurity. Does it depend upon inflammation? Gendrin thinks it does not, and assigns quite a number of reasons in support of his opinion. But do not all the phenomena of this affection indicate the reverse of this theory? Let the student compare the anatomical characters of osteitis and softening, and see if they do not strikingly resemble each other. We do not, by this, wish to be understood to mean that softening is caused by active inflammation; all that we contend for is, that the disease in question is the result of a slow, chronic irritation, leading to lesion of nutrition in the osseous tissue. It is seldom that this disorder is attended with any pain; and this may be regarded as another argument in favor of the opinion that it does not depend upon acute inflammation.

Rachitis differs from softening of the bones, properly so called, in two important particulars; first, it is peculiar to very early life, and secondly, the osseous matter, instead of being absorbed as it is in the latter disease, is not deposited in sufficient quantity originally. In both the result is the same. The affection is occasionally congenital, and sometimes, though rarely, it takes place after puberty. Of 346 cases examined by Guerin,† three occurred before birth, ninety-eight during the first year, one hundred and seventy-six during the second, thirty-five during the third year, nineteen during the fourth, ten during the fifth year, and five from the sixth to the twelfth. Of these cases, 198 were females, and the remainder, or less than one-half, males.

\* Guy's Hospital Reports, No. viii., p. 191, April, 1839.

† Memoir on Rachitis, translated by Dr. Colescott, in West. Journ. Med. and Surg., Jan. 1841.

The bones of rickety subjects are remarkably soft, spongy, sectile, and compressible; of a pink, red, or brownish color, and considerably lighter than in the natural state. They are pervaded by a great number of enlarged vessels, and saturated with a thin, sanious fluid, a considerable quantity of which is also effused upon their outer surface and into the medullary canal. The walls of the long bones are rarefied and attenuated, while those of the flat bones are more or less expanded, reticulated, and elastic. The marrow is entirely destitute of its natural properties, and the periosteum is thickened, spongy, and deeply injected. The discolored fluid, so abundantly deposited at this early period of the disease, is gradually replaced by a sort of gelatiniform substance, which becomes organized and vascular, and finally adheres with great firmness to the parts with which it lies in contact.

In the second stage, a peculiar spongoid substance is formed between the periosteum and the outer substance of the bones; it is from two to three lines, or upwards, in thickness, and often presses so much upon the walls of the compact tissue as to force them in towards the medullary canal, which, in consequence, is considerably reduced in size, or even entirely obliterated. Simultaneously with these changes the bones are rendered so soft that they may be easily cut, bent, and indented with the finger.

In the third stage — that of resolution — the newly-formed substance acquires a firm, dense, compact texture, and is gradually identified with the pre-existing tissues, which at the same time regain their primitive solidity. Owing to the presence of this matter, the bones are much larger than in the natural state, and their consistence, especially in the adult, is nearly equal to that of ivory.

The cause of rickets is not ascertained. The most ingenious conjecture regarding it is that which ascribes it to a deficiency of phosphate of lime, upon which, as is well known, depends the firmness of the osseous tissue. The probability is, that the fault resides both in the blood and in the solids. Its origin appears to be occasionally connected with syphilis, scrofula, scurvy, and difficult dentition. From the circumstance of its being sometimes witnessed in several children of the same family, it has by many been considered as hereditary. In the earlier stages of the disease, when the bones are soft, and consequently unable to support the weight of the body, or to resist the action of the muscles, there is always more or less deformity, which seldom, if ever, wholly disappears in after life.

The osseous tissue, like the soft parts, is subject to *induration*. The lesion is a natural concomitant of the third stage of rachitis, and is not unfrequently witnessed in the cranial bones, in exostoses, and in old fractures. It may occur at any period of life, but is most common in advanced age, and may affect, either separately or conjointly, both the spongy and the compact substance. The induration varies in degree from the slightest increase of the natural consistence to a state approaching that of ivory. Hence the term *eburnation* is sometimes applied to it. It is characterized by a remarkable closeness of the osseous tissue, the cells of which are filled with inorganic matter, without any evident morbid condition. The affected bone may retain its natural size, but in general it is somewhat increased; in a small proportion of cases it is sensibly diminished. Its weight is usually augmented, its form more or less changed, and its density so great that it is exceedingly difficult to break or saw it. In this respect it offers a striking contrast to fragility of the osseous tissue. The cause of this transformation is quite unknown.

The bones are liable to become preternaturally brittle, crumbling to pieces under the most trifling accidents. The disease, which is technically called



*fragility*, is most commonly found as an attendant on old age, and is seldom restricted to any particular class of bones, though the cylindrical are perhaps the most prone to it. The cause of this singular affection has been a source of much theoretical discussion. The best writers, however, agree in referring it to a lesion of nutrition, produced by a diminution of the number and volume of the vessels of the osseous tissue. The validity of this opinion derives great plausibility from a contemplation of the changes which the bones undergo in the different periods of life. In childhood, the osseous tissue is remarkably flexible and pliant, and contains a large amount of animal substance; in old age, on the contrary, it is very dense, hard, calcareous, and extremely liable to break, the slightest exertion or accident being often sufficient to cause this result. The number of fractures sometimes produced in this way, even in young persons, is truly astonishing. Devergie\* states that he dissected, in 1818, a female, who died under symptoms of fragility, in whose skeleton he found not less than eighty-three fractures. Dr. Gibson† gives the case of a young man, nineteen years of age, in whom the bones of the arm, fore-arm, thigh and leg, have all been repeatedly broken, from the most trivial causes. The clavicles have suffered still more frequently, having been fractured eight times. Fractures from this cause sometimes occur in the fœtus in the womb. Chaussier has related a remarkable example of this kind, in which each of the long bones presented one or more of these lesions, some of which were recent, others beginning to unite, whilst others were consolidated. The child survived its birth only twenty-four hours. Somewhat similar cases have been reported by Gardener and Glöckengieser.

Bones affected with this disease are sometimes completely saturated with oily matter, which renders them unfit for preparations; but, in most instances, they are dry, brittle, and crumble to pieces under the slightest pressure. In the latter stages of scurvy and scrofula, they become often extremely fragile; and, if they be boiled, they break down into thin, irregular scales, or are almost entirely dissolved. The disease is rarely attended with pain, and the general health is usually remarkably good. When fractures occur, they sometimes rapidly unite; at other times, however, restoration does not take place, or only after a very long period.

*Hypertrophy* of the osseous tissue may be partial or general; that is, the abnormal growth may affect either a portion or the whole of a bone. The latter, however, is a very rare occurrence, though perhaps not so much so as has been imagined. Cases, indeed, not infrequently occur, in which the broad bones of the head present an extraordinary degree of development, being more than an inch in thickness, and so hard that it is almost impossible to saw them. Under these circumstances, the two tables are extremely compact, and the intermediate spongy structure is totally obliterated, or rather replaced by dense, earthy matter. Similar appearances are sometimes witnessed in the cylindrical bones of the extremities. In an old femur in my private collection, the medullary canal is scarcely large enough to admit a common-sized quill; the whole shaft seems to consist almost entirely of compact substance, in many places more than six lines in thickness. The bones of the male are always larger and more distinctly developed than those of the female; and the bones of persons who take much exercise, than those who are indolent, or make little exertion. By labor, their weight and dimensions increase; their spongy structure diminishes, whilst the compact becomes harder, of a closer grain, and acquires an almost

\* Dictionnaire de Med. et Chirurg. Pratique, t. x., 1833.

† Institutes of Surgery, fifth edition, vol. i., p. 233.

rock-like solidity ; the muscular prominences are rendered more conspicuous ; — in short, everything indicates that they are in a state of general hypertrophy. When thus circumstanced, the osseous tissue usually contains a due proportion of animal matter ; and hence it is always capable of resisting, in a very eminent degree, the influence of such agents as have a tendency to injure it.

The adjoining cuts are excellent representations of general hypertrophy of the femur of a man affected with tertiary syphilis. Fig. 84 is a section of the bone exhibiting its interior structure, which is very much condensed throughout, except at the superior extremity, where there are still some remains of the areolar tissue ; the medullary canal is entirely obliterated, and the weight of the bone is nearly twice as great as in health. Fig. 85 shows the external appearance of the bone. The drawings are from a specimen in my cabinet.

When the hypertrophy is partial, it constitutes what is called an *exostosis*, — a Greek term, literally implying an exuberant growth of bony matter. Tumors of very opposite characters have been described by writers under this head, and, as might be expected, much confusion has been the result. To avoid this, if possible, in the present instance, I deem it necessary to state that, by the word *exostosis*, I understand, in common with the best pathologists of the day, simply a bony excrescence, similar in its structure to the osseous tissue in its normal condition. Nothing, it seems to me, can be more unscientific than the classification of Sir Astley Cooper, who has described under this head some of the most malignant diseases to which the bones are subject.

The bones most commonly affected by this species of hypertrophy are the femoral, frontal, parietal, and lower maxillary, the relative frequency of its attack being in the order here stated. No part of the skeleton, however, is exempt from it ; and, in a few instances, it has been known to affect a large number of pieces at the same time, as if there had been an exostotic diathesis. Great variety prevails in regard to the size and shape of these tumors. In general, they look like small, irregular excrescences, with a rough, scabrous surface ; but sometimes, especially when they are seated on the flat bones, they are of a spherical form, and nearly or quite smooth. In other cases, again, they have a mammillated appearance ; or they form flat discs, resting upon a short, narrow, pedicle ; or finally, they are rounded, nodular, or knob-like. Their size seldom exceeds a small apple, orange, or potato, though examples are occasionally met with, where they are as large as a cocoanut or a fetal

Fig. 84.



Fig. 85.



head. In a specimen in our museum of morbid anatomy, the walls of the left maxillary sinus are literally studded with these growths, none of which exceeds a small grain of wheat, which they also very much resemble in shape. Fig. 86, from a specimen in my collection, conveys a good idea of an exostosis of the thigh-bone.

Fig. 86.



In their structure, exostoses present all the varieties of the natural bone upon which they grow, being composed of a soft, spongy texture, enclosed by a layer of solid, compact matter. They may be surrounded by a coat of cartilage, or have all the firmness and density of ivory. In the healthy state, they are perfectly insensible; but they are susceptible of inflammation, and it is probable that, when laboring under this disease, they experience those changes which have obtained for them the names of fungous, medullary, and cancerous, so much in vogue among surgical writers.

These tumors are formed in the same manner as the osseous tissue in other parts of the skeleton, passing always through the same stages of ossification. That this is the case, will appear sufficiently obvious, if we refer for a moment to the causes by which they are produced. Among these, the most common, perhaps, are the various kinds of external violence, such, especially, as blows or contusions; though many contend for a scrofulous, gouty, or syphilitic origin. Induced in any of these ways, there must be local inflammation, either in the bone,

or in the periosteum, or in both,—one of the effects of which is an effusion of coagulating lymph. This, after some time, is converted into cartilage, and this finally into bony matter.

Some exostoses are extremely rapid in their growth, and soon attain a very considerable magnitude; most commonly, however, their development is gradual, going on for many years without causing any serious inconvenience. They are seldom attended with much pain; indeed, it is only when they are very large, or when they degenerate into cancerous affections, that they become a source of local annoyance and constitutional disturbance. Youth seems to be the period in which these growths are most frequent, though adults and old persons are not exempt from them.

*Atrophy* of the osseous tissue is characterized by the partial absorption of its elementary constituents, as is evinced by its lightness and porosity. The lesion may occur in any portion of the skeleton, but the long bones are oftener affected than the short or flat. Like hypertrophy, it may be partial or general, that is, it may involve an entire piece, or be limited to a particular part of it. Atrophy, moreover, may be concentric or eccentric. In the former variety the bone is diminished in its diameter; in the latter it retains its original size, but is reduced in weight, and rarefied in its tissue. The causes under the influence of which it may take place are, protracted pressure, chronic inflammation, deficient nervous influence, and insufficient supply of arterial blood.



*a.* That pressure, steadily exerted for a considerable length of time, has a tendency to produce atrophy of the osseous tissue, is familiarly known to pathologists. This is well exemplified in the cranial bones in tumors of the dura mater; in the sternum and dorsal vertebræ; in aneurism of the aorta; in the ribs; in cancer of the mammary gland. In all these instances, the compact substance is reduced to a thin, translucent plate, while the spongy texture is either wholly destroyed, or worn down to a few slender threads. The immediate cause of the wasting process here is absorption, acting simultaneously and equally upon the animal and earthy constituents.

*b.* Atrophy from chronic inflammation appears to be infrequent. The best specimen of it that I have seen occurred in a colored woman, who died of pulmonary phthisis at the age of forty. The body was much emaciated, and all the long bones were remarkably reduced in weight, though they had experienced no change in their external configuration. The compact substance was wasted to a mere shell, scarcely thicker than common wrapping paper, and the cells of the spongy texture were increased many times beyond the natural size. The medullary canal was much enlarged, and filled with a greasy, reddish substance, not unlike fresh adipocire. These appearances are well shown in the accompanying cut (Fig. 87), and afford a beautiful illustration of the eccentric form of atrophy.

Atrophy is sometimes the result of local injury, as a blow, wound, or contusion. The wasting in this case may be limited to the site of the original mischief, or it may extend to the entire bone, which, however, is rare. In what manner such an injury operates, whether through the agency of inflammatory irritation, or otherwise, in giving rise to atrophy, is unknown.

*c.* Deficient nervous influence is a frequent cause of atrophy both of the osseous tissue and of the soft parts. In paralysis of the lower extremities, there is generally notable wasting, not only of the muscles, but also of the long bones, which are greatly reduced in weight, rarefied in their texture, and diminished in size. Lobstein\* records a remarkable case of this description, referred to in a previous chapter. The man died at the age of fifty-four, with extreme atrophy of the right leg, which appeared to be consequent upon a fall received when he was a child, and by which the great nerves of the limb were severely injured. All the soft parts were excessively wasted, and the right femur weighed little more than three ounces, while its fellow weighed nearly double. The nerves and vessels were not perceptibly changed. Where atrophy is produced by deficient nervous influence it is generally concentric; that is, the bone is sensibly diminished in size without any evident alteration in its external configuration.

*d.* The effect of a diminished supply of blood in inducing atrophy of bone is very conspicuous in old fractures. Mr. Curling, in an able paper in the twentieth volume of the Medico-Chirurgical Transactions of London, has

Fig. 87.



\* *Traité d'Anat. Path.*, t. i., p. 90.

satisfactorily shown that in injuries of this description there is often considerable wasting of the osseous tissue, in consequence merely of the obliteration of the nutritious artery by the callus. The atrophy is always eccentric, and is usually limited to one-third, one-half, or two-thirds of the affected bone, according to the seat of the original injury, or, more properly speaking, the quantity of the new matter, and the extent of the vascular obliteration.

Fig. 88.



e. Finally, there is a species of senile atrophy. In old age, the bones are rendered light, porous, and brittle; the compact substance is reduced to a mere parchment-like shell, while the areolar texture is remarkably rarefied or expanded; the muscular prominences are diminished in size; the animal matter is partially absorbed; and many of the vessels are obliterated. These changes are no where more conspicuous than in the neck of the femur, which, in consequence, often breaks from the most trifling causes, and which, after this occurrence, is seldom, if ever, repaired by osseous matter. Fig. 88 is a section of a well-marked specimen of this kind; the internal structure is very much rarefied; the head of the

bone, flattened and expanded, is approximated to the shaft, from the partial absorption of the neck.

The bones are occasionally infested by *hydatids* or *acephalocysts*, of a globular form; they vary considerably, both in number, in size, and in the appearance of their contents. There may be only two or three, or they may exist in much greater number. In size they range between a hemp-seed and a pullet's-egg. At an early period they are perfectly smooth, transparent, and occupied by a light colored, serous fluid. They are liable, however, to become indurated, and their contents are sometimes rendered turbid, viscid, and albuminous.

The portions of the osseous system most subject to these bodies are, the tibia, particularly its superior extremity, the frontal bone, the ilium, the humerus, the spine, and femur. It is very seldom that they exist simultaneously in several pieces of the skeleton. They are usually developed either in the spongy structure, or in the medullary canal, which they distend in every direction, so as to form a chamber several inches in diameter. The parietes of this cavity are generally very thin, and liable to become perforated by ulcerative absorption. The *hydatids* may be adherent, or they may float about in the serous contents of the osseous cyst.

Sex does not appear to exert any particular influence upon the production of this disease. It is most common in adults, but has been met with in young subjects, and even in children. Its causes have not yet been satisfactorily investigated; nor are its symptoms such as to enable us, in the present state of our knowledge, to distinguish it from other affections. In the instructive case related by Mr. Keate\* of London, the *hydatids* were developed in the frontal bone, which formed a tumor immediately over the left eye, about the size of an orange. The patient was a young female, and the complaint had been coming on for a number of years. In another case, mentioned by Cruveilhier, the disease was seated on the anterior part of the tibia, and had the appearance of an indolent steatomatous growth, with a hard, irregular border. On being laid open, it gave vent to a thick, inodorous fluid, resembling the dregs of wine. One of the most

\* Medico-Chirurg. Transactions, vol. x., p. 178: London, 1819.

singular features of these cysts is their indestructible nature, being almost sure, unless completely destroyed, to be speedily regenerated.

*Aneurism* of the osseous tissue, although incidentally, indeed, by some of the older pathologists, was first clearly described by Mons. Breschet,\* of Paris. The disease, which, on the whole, is extremely rare, consists in an extraordinary development of the minute vessels, and presents precisely the same anatomical features as aneurism by anastomosis of the soft parts. Confined usually to one bone, it may occur in several, or even in a considerable number. In the interesting case mentioned by Scarpa it was discovered in the cranium, sternum, ribs, vertebræ, and innominatum of the same subject. Its favorite seat is the upper extremity of the tibia, just below the knee. It may arise at various periods of life, but is most common in young adults. The tumor varies in volume from a pullet's-egg to a cocoa-nut. Dupuytren saw an instance where it was thirty-two inches in circumference.

The disease always begins in the cancellated structure, which is converted into various sized chambers, filled with coagulated blood, disposed in concentric layers, as in old aneurismal tumors. Some of the cells occasionally contain fluid blood, or blood partly fluid and partly clotted; but this is rare. The outer table of the bone is expanded, attenuated, and perforated, or so soft, flexible, and elastic that it may be bent like cartilage. In some instances, on the other hand, it is remarkably brittle, and may be crushed like the shell of an egg. The periosteum is thickened and indurated; but the joints in the immediate vicinity of the disease are commonly healthy, even when they are separated from it merely by a thin layer of cartilage. The vessels which ramify through the substance of the bone are tortuous and brittle, increased in size, and open by numerous little orifices into the aneurismal sac in the centre of the diseased mass.

The causes of this lesion are involved in obscurity. In some instances, it has been attributed to a blow; in others, to a fall or jump from a considerable height. Either of these causes, by disturbing the vascular action of the bone, might produce the disease. Occasionally it is connected with a gouty or rheumatic diathesis, and then probably depends upon inflammatory irritation.

An osteo-aneurismal tumor is tense, painful, and tender on pressure. When fully developed, a deep seated pulsation is observable in it, isochronous with that of the heart, and somewhat similar to the motion imparted by an anastomotic aneurism of the face. By compressing the main artery of the limb above the tumor, the pulsation ceases, but reappears immediately when the pressure is removed. This fact may be regarded as diagnostic of the disease.

There is a variety of tumor, closely allied to that just described, which, for the sake of uniformity in medical nomenclature, may be termed *hematoid*. It is produced by a deposition of blood in the cancellated structure, and was first noticed by Mr. Travers,† of London, in a boy ten years old. The clavicle, the whole of which was extirpated, was expanded into a firm, oval, and elastic tumor, surrounded by the periosteum, and converted into cavities filled with dark solid coagula. The disease had existed about a year, and appears to have been caused by a blow, which probably produced a rupture of the vessels of the bone, and an extravasation of blood in the cancellated structure.

Last October, I amputated a portion of the lower jaw, affected, as was supposed, with osteo-sarcoma. The tumor, about the size of a common orange,

\* Observations et Réflexions sur les Tumeurs Sanguinées des Os; Repertoire Générale d'Anatomie, &c., t. ii. Paris, 1826.

† Medico-Chirurg. Trans., vol. xxi., p. 135.

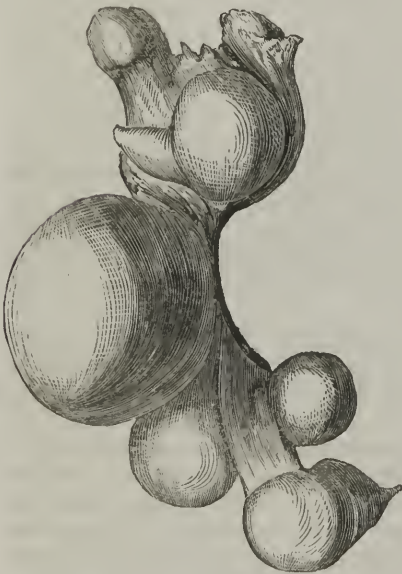


extended from the canine tooth on the right side to the middle grinder of the left, and was found to consist of a mere osseous shell, without any vestige of the cancellated structure, and occupied by three red, solid coagula, the largest of which did not exceed the volume of a pigeon's-egg. The cavity was only partially filled by the clotted blood, which adhered to the inner surface of the bony wall, and was evidently organized. The patient was a farmer, thirty-five years of age, and the tumor first appeared three years before without any assignable cause.

The *fibro-cartilaginous tumor* may be developed in the cancellated structure, or upon the outer surface of the bones, beneath the periosteum. Its figure is globular; its surface rough, or nodulated; its consistence firm, dense, and elastic; its color white, or greyish. When boiled, it yields a peculiar form of gelatine, termed *chondrin*. The tumor is essentially composed of a fibrous

and a cartilaginous substance. The former constitutes the nidus in which the latter is deposited, and consists of a vast number of oblong or rounded cells, from the size of a clover-seed to that of a pea. These cavities cannot generally be distinguished until the cartilaginous element has been scraped away, or removed by maceration. The morbid mass is strikingly conglomerate, and often attains a large bulk. When it originates, as it commonly does, in the central part of the bone, it gradually encroaches upon the compact tissue, which it expands into a thin, porous shell, either entirely osseous, or partly osseous, and partly cartilaginous. Finally, the attenuated lamella gives way at one or more points, and thus allows the morbid growth to protrude beneath the periosteum, which is itself often very much altered in its character. Fig. 89 is a representation of several fibro-cartilaginous tumors of one of the digital phalanges.

Fig. 89.



This tumor ordinarily affects only one bone; it is not malignant, and is productive of little inconvenience, except from its size. It is peculiar to early life, is often directly chargeable to external violence, manifests no tendency to degeneration, not even when of long standing, is generally slow in its progress, and occasionally appears simultaneously in several parts of the skeleton. Every portion of the osseous system is liable to it; but the pieces most frequently affected are the metacarpal bones, the phalanges of the fingers, the humerus, and the lower jaw. To the tumor now described, especially when it is hard, fibrous, and interspersed with debris of osseous matter, or red and dense, like half-boiled beef, or fresh pork, the unmeaning title of *osteosarcoma* is usually applied by surgical writers.

*Encephaloid*, fungus hæmatodes, or cerebriform cancer, generally, if not invariably, originates in the spongy structure, from which it gradually extends to the compact lamella, and finally to the periosteum. It most commonly attacks the upper and lower jaw, and the long bones of the extremities, particularly the femur, humerus, and digital phalanges. No portion of the ske-

leton, however, is exempt from it. The most terrific feature of encephaloid is its tendency to recur in some other part of the body, after it has been dislodged from its original situation. It may occur at any period of life, but young persons are most prone to it.

The encephaloid substance may occur as in infiltration, but most commonly it presents itself in the form of a tumor, arranged in rounded, lobulated masses, of the color and consistence of the medullary structure of the brain. Not unfrequently it contains small cavities, filled with clotted blood, dirty looking serum, or soft, gelatinous, oily, sebaceous, or melliceroid matter. Occasionally one part of the tumor exhibits the brain-like character, while the other is strictly hæmatoid, or composed of a mixture of blood and encephaloid. In the great majority of cases, however, the two substances are pretty intimately blended together. Vessels, sometimes of considerable volume, may be seen ramifying over the surface of the morbid growth, and dipping into its interior. The outer table of the bone is transformed into a thin, parchment-like lamella, perforated in various places, or entirely destroyed by absorption. A section of the tumor usually exhibits, in addition to the appearances already described, osseous fragments, or pieces of fibro-cartilage. The superincumbent integuments, traversed by large bluish veins, are at first soft and glossy; but at length, from the constant and increasing pressure, they ulcerate, and allow the fungous mass to protrude.

*Scirrhus* of the osseous tissue is singularly rare. It occurs exclusively in old subjects, and is usually concomitant of the same disease of the breast or some other organ. Generally limited to a single bone, it may affect several pieces simultaneously, and always begins in the cancellated structure. Its favorite seat is the femur, but it may appear in any part of the skeleton, in the short and flat bones, as well as in the long.

The heteroclite matter is deposited under two varieties of form, the infiltrated, and the tuberoid. In the former it is diffused through the areolar tissue, and exhibits the color and consistence of fibro-cartilage, or the rind of fresh pork. In the tuberoid variety the morbid mass is either solitary, or it consists of several agglomerated nodules, from the volume of a hazelnut to that of an almond. Occasionally three or four distinct tumors are developed simultaneously in the same bone, as is shown in the accompanying cut (Fig. 89). They are of an irregularly rounded or oval shape, dense and firm in their consistence, and of a greenish, whitish, or yellowish color. The bone is seldom much altered in its size or external configurations, but is liable to be absorbed, and fractured at the seat of the disease.

Of *colloid* of the osseous tissue very little is known. According to Cruveilhier, this is the form of carcinoma most frequently met with in the diseased conditions of the bones denominated osteo-sarcoma and spina-ventosa; and in this opinion I am disposed to concur from the fact that tumors of this description are often almost wholly composed of cells and cavities filled with jelly-like matter. The question, however, respecting the identity of these affections can be determined only by future observation. A case in which a colloid tumor grew from the body of the sphenoid bone, outside the dura mater, came under my notice last autumn, in the medical ward of the Marine Hospital of this city. The patient died at the age of thirty-nine years from epilepsy, produced by a fall received twelve months previously. On examination, Dr. Colescott and myself found, in the situation referred to, a lobulated tumor, of irregular form, and about the size of a pullet's egg, which had flattened the varolian bridge, and evidently induced the disease in question. A section of the morbid mass showed that it was composed of several compartments com-

municating with each other, and occupied by a white, semi-concrete substance, in all respects similar to that of colloid.

*Melanosis* of the osseous tissue is exceedingly rare. It may appear in small disseminated masses, nodules or clusters, or in the form of infiltration. It has been observed in various parts of the skeleton, but seems to be most common in the pieces of the extremities, particularly the femur and tibia. Co-existing generally with melanosis in other organs, it is situated either upon the surface of the bone, beneath the periosteum, in the medullary canal, or in the spongy structure, the latter of which it sometimes dyes of a deep black color. In its progress and mode of termination it closely resembles medullary sarcoma.

*Tubercles* of the bones are much more common than is generally imagined by pathologists. From the recent researches of some of the French anatomists, especially of Nichet and Nélaton, there is every reason to believe that what is

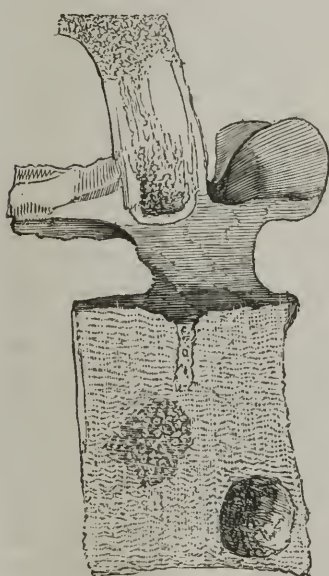
named Pott's disease is owing, in most cases, to the development of these bodies. They are not, however, confined to the vertebræ; in many instances they affect the short bones in other situations, and they seem to be very often deposited in the articulating extremities of the long ones. The particular seat of tubercles is the spongy texture, though occasionally they are formed upon the outer surface of the bones, between it and the periosteum. Fig. 90 shows two circumscribed tubercular deposits in the body of one of the dorsal vertebræ; the matter is in a crude state, and the surrounding tissues are perfectly healthy.

There are two varieties of form in which this matter may be deposited. In one, perhaps the most common, the tubercles are *encysted*, the enclosing membrane, which varies in thickness from a fifth to half a line, being composed of coagulating lymph, very soft at first, but

gradually becoming harder and harder, until finally, in some cases, it acquires the character of fibro-cartilage. It is of a dull greyish color, is made up of delicate, inelastic fibres, crossing each other in every conceivable direction, and is furnished frequently with small vessels, passing into it from the surrounding structure. The number of tubercles is seldom very great; their size varies from that of a pea to that of a nutmeg; and in most cases they present a yellowish, opake appearance. Occasionally these bodies become softened, when the matter will either work its way out, or pass, by a sort of fistulous route, into a neighboring joint, establishing thereby an analogy with pulmonary tubercles opening into the bronchial tubes. Sometimes a spontaneous cure takes place, the heterologous substance being absorbed, and the cyst contracting so as to obliterate its cavity.

In the second variety, the tubercular matter is deposited directly in the cells of the osseous tissue, forming greyish, semi-transparent, opaline patches, from one-sixth of an inch to an inch in diameter. This infiltration is noticed chiefly in the bodies of the vertebræ, where it is frequently pervaded by numer-

Fig. 90.





ous vessels, too delicate to be discerned with the naked eye. The bony tissue immediately around is sometimes deeply injected, but seldom otherwise diseased. In this, as in the preceding variety, the tubercular deposit, after having existed for some time, gradually softens, its vascularity disappears, and the cells in which it was contained are filled with earthy matter. This, however, is not always the case; for now and then the ulcerative process continues until the bone is totally destroyed.

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## SECTION II.

### OF THE PERIOSTEUM.

The outer surface of the bones is every where closely invested, excepting at their articular extremities, by a tough, fibrous membrane, which is hence called the periosteum. In its structure, it strictly resembles the dura mater, the pericardium, and the aponeurotic sheaths of the muscles, being, like them, composed of strong, dense, and inelastic filaments, matted together in the firmest and most inextricable manner. Of the two surfaces which this membrane presents, the external is rough, and covered by a small quantity of cellular substance, by which it is connected to the surrounding textures: the inner, although not perfectly smooth, is much less flocculent than the other, and is joined to the bones by an immense number of little slender processes, which extend into the osseous tissue, and serve to transmit the nutrient vessels. In certain regions of the body, as in the mouth, nose, ear, and sinuses of the head, the periosteum is in immediate contact with the mucous membrane, to which it adheres with extraordinary tenacity. It consists every where of a single lamella, the thickness of which varies from the fifth of a line to the twelfth of an inch, according to the age of the subject, and the situation in which it is located.

The periosteum has a plentiful supply of blood-vessels, which are derived from the adjacent branches, and which freely anastomose with those of the bones. Its nerves and lymphatics are few in number, and so excessively delicate as to elude the unassisted eye. In health, the membrane possesses little sensibility; but, when under the influence of inflammation, the patient suffers the most acute pain, which is often relieved by dividing the diseased texture.

In infancy, this membrane is soft, thick, and spongy, and may be readily detached from its connections. In adult life, it is more firm and compact, and adheres so intimately to the bones that it is separated with difficulty. In old age, it is extremely tough, and not unfrequently ossified on its internal surface. Its vascularity, which is at first rather obscure, also gradually increases as we advance in years, but again diminishes in old age. The color of this membrane is likewise subject to considerable variation. In the young it is of a lilac tint, which becomes lighter towards middle life, and is finally replaced by a dull white. In persons who die from asphyxia, the color of the periosteum is generally a few shades deeper than in such as perish from lingering diseases.

The morbid relations of the periosteum, although not unlike those of other fibrous textures, are too important to be passed by without some notice. The

most common lesion to which this membrane is liable is chronic inflammation, followed by thickening, and a deposit of osseous matter, generally upon the internal surface, but occasionally upon the external. Acute inflammation is also frequently observed, and seldom exists without implicating the subjacent bone.

Inflammation arises either spontaneously, from external injury, or from the operation of the syphilitic poison. In the acute form of the disease, the membrane becomes reddened, its vessels are loaded with blood, and its substance is sensibly softened as well as slightly thickened. Its attachment to the bones is also considerably diminished, so that it can be much more easily peeled off, and the cellular substance on its external surface is generally infiltrated with sero-albuminous matter. These changes are frequently observed upon the fragments of a broken bone, and in incised wounds of the muscles, involving the periosteum.

This disease, especially the acute form of it, not unfrequently passes into suppuration. This event is more particularly apt to occur in periostitis of the inferior extremity, caused by cold operating upon a strumous constitution, or by the effects of mercury, or the action of the syphilitic virus. In either case, the suppurative process is remarkably tardy, and the pus is rarely of a healthy character, but almost always very thin, bloody, and offensive, with flakes of curdy matter. As the fluid accumulates, the superincumbent integuments assume a red, glossy, and swollen appearance; the part is excessively painful; fluctuation takes place, and the abscess breaks at one or more points: the corresponding portion of the bone is frequently destroyed by ulceration.

Another termination of acute inflammation is mortification. When this occurs, the normal appearance of the membrane is lost, and changed to a dirty ash color, whilst its texture is softened, easily torn, and bathed in a foul offensive fluid, having the characteristic gangrenous odor. This termination, it need scarcely be observed, can never take place without the osseous texture participating in it. The best examples of it are witnessed in the periosteum of the alveolar processes of the jaws, from the abuse of mercury, and in that of the tibia from common necrosis. The sloughs, which are always tough and shreddy, are usually thrown off with considerable difficulty, owing to the tardy and imperfect action of the circumjacent structures.

When the periosteum labors under chronic inflammation, it is very apt to become thickened from the effusion of plastic lymph. The hypertrophy, for so it may be termed, generally occurs in association with induration, and often involves a considerable extent of surface, forming a diffuse, incompressible swelling, partly fibrous, partly cartilaginous, and partly osseous. In other cases, the hypertrophy is more circumscribed, and either exhibits the mixed structure just specified, or it is entirely bony. These tumors are commonly of slow formation, and they seldom acquire any great bulk. During the progress of their development, they are the seat of a constant, deep-seated gnawing pain, which is most severe at night, when the body becomes warm in bed. After continuing for an indefinite period they either remain stationary, or they gradually disappear by absorption, or they excite suppuration in the super-imposed textures.

In old people, it is not uncommon to find this membrane ossified upon its internal surface, or even through its entire substance. When thus affected, the periosteum is of a dull drab color, resists the knife, and is with difficulty detached from the bone which it covers, owing to the partial incorporation of their tissues. When dried, it exhibits very much the appearance of an ossified

artery. In the extremities, especially in the thighs, I have frequently seen considerable nodules of bone spring from the outer surface of this membrane, so as to encroach more or less upon the muscles. In their shape, they are, for the most part, ovoidal, and in their consistence they fully equal the petrous portion of the temporal bone. Their color is usually a few shades lighter than that of the osseous texture in the healthy state.

The periosteum has been found affected, in a few rare cases, with melanosis; and occasionally, also, with the tubercular deposit. In carcinoma of the bones, the membrane is often implicated secondarily, but it is rarely, perhaps never, the original seat of this formidable malady. In a number of dissections which I have made of encephaloid disease of the bones and soft parts, I have found the periosteum entirely untouched, not even thickened or indurated. Hence we may infer that this fibrous lamella possesses an astonishing self-preserving power, much superior to what is enjoyed by most other tissues.

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### SECTION III.

#### OF THE MEDULLARY MEMBRANE.

There is another structure, which, from its important relations with the bones, demands a few remarks before we finally close the present chapter. I need scarcely say that I allude to what is called the medullary membrane.

This delicate and beautiful structure is generally described as being entirely restricted to the canals of the long bones, — an opinion which is not easily explained, when it is recollected that the cells of the areolar texture of these organs are constantly filled with adipous matter, which it is the proper office of this membrane to elaborate. True, it is not so easily demonstrated in the latter as in the former situation; but the fact just referred to amply proves that it must exist there; otherwise it would be impossible to account for the presence of adeps. To display the medullary membrane, it is necessary to saw one of the cylindrical bones in the longitudinal direction, and then plunge it into boiling water, or expose it to the action of some dilute mineral acid. The membrane will thus become detached from the parietes of the internal canal, and adhere to the adipous substance, so as to appear perfectly distinct. If it be now carefully inspected, it will be found to be essentially composed of cellular tissue, blood-vessels, nerves, and lymphatics. It is pierced by a multitude of minute foramina, and is so thin and delicate as to bear a striking resemblance to a spider's web. It is connected, on the one hand, to the parietes of the bones by very thin and slender processes; and, on the other, it detaches an immense number of septa, which, by their interlacement with the internal cancellated structure, and with each other, form a vast multitude of cells, similar to those of the adipous tissue in other parts of the body, both as respects their structure and functions. The sensibility of this membrane is very obscure in the normal state.

Of the diseases of the medullary membrane, not enough is known to enable us to speak with any degree of decision. Acute inflammation is extremely rare, and is observed principally in fractures of the long bones. The membrane in this form of the lesion assumes a reddish tint, and the secretion of fatty matter is not only temporarily suspended, but that which existed prior to the occurrence of the accident is generally absorbed. In violent cases, pus is effused, and forms an abscess in the interior of the bone. In necrosis, the



medullary membrane, corresponding with the affected portion of bone, loses its vitality, and is gradually broken up into a dark-colored, oily putrilage, of a fetid, gangrenous odor.

Chronic inflammation of this membrane, I have recently seen in the tibia and fibula of a man sixty years of age, who died from the effects of a sloughing ulcer, brought on apparently by intemperance. Both bones were in a state of necrosis at their middle; inferiorly they were greatly expanded, but towards the knee they were of the natural dimensions, and contained a red, florid-looking marrow, of preternatural hardness. The discoloration, however, was not uniform, but occurred in distinct patches, varying in diameter from that of a pea to that of a twenty-five cent piece.

Since the adipous tissue of the bones bears the greatest resemblance to that in other parts of the body, it is highly probable, I think, that it possesses certain modifications of structure, leading to corresponding peculiarities in reference to its diseases. That this is the case, I am disposed to believe, from the fact that the medullary membrane is not unfrequently the seat of several of the heterologous formations, such as the scirrhous and encephaloid, which are never developed, so far as I know, in the adeps of the general system. The tubercular matter is also sometimes deposited here; and another argument in favor of this view is founded upon the notable difference in the products of the two tissues, that of the bones being always of a thin, oily nature, and composed principally of elaine, the other, semi-concrete, and formed mainly of stearine.

## CHAPTER X.

### OF THE CUTANEOUS SYSTEM.

#### SECTION I.

##### OF THE SKIN.

- I. *The Skin.* — Number of Layers. — Epidermis. — Mucous Web. — Dermis. — Papillæ. — Sudoriferous Glands. — Sebaceous Follicles. — Reproductive power of the different lamellæ of the Skin. — Diseases. — (1.) Unclassifiable Lesions. — Keloid — Melanosis. — Encephaloid. — Cartilaginous Tumors. — Eiloid. — Lepoid. — Hypertrophy. — Corns. — Warts. — Horny Excrecences. — Gangrene. — Sebaceous Tumors. — Hemorrhages — (11.) Classifiable Lesions. — 1. Exanthematous Diseases. — 2. Pustular. — 3. Papular. — 4. Bullar. — 5. Tubercular. — 6. Scaly. — 7. Syphilitic Diseases. — 8. Stains. — II. *The Nails.* — Situation, Composition, and Arrangement. — Growth. — Reproductive Power. — Inordinate Length. — Absence. — Malformation. — Vicious Situation. — Onyxitis. — III. *The Hairs.* — Similarity to the Nails. — Situation. — Consist each of a Follicle and Stem. — Organization. — Polish Plait. — Regenerating Power. — Hypertrophy. — Female Beards. — Softening. — Fragility. — Changes of Color. — Accidental development of Hair.

WITH the situation and appearance of the skin every one is familiar. Forming a general envelope for the body, it answers the same purpose to the outer surface that the mucous membranes do to the excretory canals, into the openings of which it dips, so as to participate in their structure. Varying in thickness, from the sixth of an inch to the third of a line, it presents considerable diversity not only in different regions, but likewise in the different periods of life, being extremely soft and delicate in infants, more firm and resisting in adults, flabby and wrinkled in old age. It is also more delicate in the female than in the male, and in health than in disease, when it is frequently hard, dry, and shrivelled.

Much contrariety of sentiment still exists among anatomists respecting the

precise number of layers of which the skin is composed, — some, as Chaussier and Gordon, asserting that there are only two; some, that there are three; some, that there are four; and others, again, that there are as many as five, six, or even seven. The second of these opinions, however, is that which has received the greatest number of advocates, and is the one which accords best with the results of my own dissections. Adopting this view, we shall find that the external tegument is made up of three distinct strata, — an outer, middle, and inner; the first being named the cuticle, the second the mucous web of Malpighi, and the third the dermis or true skin.

The *cuticle*, also called the epidermis, or scarf-skin, is the most superficial layer of the three, being spread over the mucous web like a thin varnish of gum shellac. Of a dull white color, it is elastic, hygrometric, transparent, and so yielding in texture, that it readily tears. It is rendered yellow, and finally dissolved by immersion in nitric acid, swells a little when macerated in water, emits a peculiar animal odor on being exposed to a red heat, is nearly imputrescible, and is composed principally of albumen, with a small quantity of gelatine and salts.

The epidermis consists every where of a single lamella, except in the sole of the foot, where, from mechanical pressure, it is frequently separable into several distinct layers. Its thickness, which is greatly increased by exercise, varies in different regions of the body; but, in most places, it is about the one-sixth part of that of the corion, which it covers. Externally, the epidermis has a rough, wrinkled appearance; it is covered, moreover, with innumerable hairs, and is constantly moistened by the secretion of the sebaceous follicles. The internal surface is slightly mammillated, and so closely united to the subjacent layers that it is impossible to separate it by dissection. It is readily detached, however, by putrefaction; and when this is done, it is found to present, besides a great many little rounded projections, a considerable number of very delicate, transparent, and colorless filaments, the precise nature of which is still undetermined, though they are probably nothing more than little albuminous processes, which, extending from the cuticle to the dermis, serve to connect them more firmly together. It is the opinion of many anatomists, that the epidermis is porous, and such is no doubt the case. The fact that no openings, save those which give passage to the hairs, have ever been detected, even with the assistance of the most powerful microscope, does not prove that there are none; for, as has been observed by a distinguished writer, it is possible that they might originally exist, and yet not be visible in the detached cuticle, on account of their being closed by its elasticity, which is one of its most strongly marked physical properties.

The epidermis was formerly regarded as being composed of scales, and this opinion has been recently revived by two eminent French anatomists, Breschet and Vauzème, in an excellent little work on the minute structure of the skin, published at Paris, in 1835. According to these writers, the scales of the cuticle have the general form of an irregular trapezium: they are striated, white, and transparent, of uniform thickness, and placed upon a very thin pellucid membrane, evidently areolar in its structure. They further assert that the epidermis is the product of a peculiar *mucific apparatus*, situated at the bottom of the true skin, and composed of a small reddish gland, with an appropriate excretory duct. The matter secreted by this structure is at first perfectly fluid, but by degrees it becomes hard and dense, until it has acquired all the properties of the membrane under consideration. Dr. Gurlt, of Germany, who has more recently investigated this subject, has not been able to

detect the mucific apparatus described by the French authors; and it is obvious that further researches are necessary before their statements can receive the sanction of the anatomist and physiologist.

Few organs have afforded a wider field for the range of physiological fancy than the epidermis. At one time it has been considered as vital and organized; at another, as destitute of the characteristics of living matter. The latter is still, from some unaccountable cause, the prominent belief of authors and teachers. That the organization of the cuticle is equal to that of the dermis and other similar textures, it would be as absurd to presume, as it would to suppose it wholly destitute of vitality. Three circumstances may be stated here as illustrative of the present subject. In the first place, we may conclude that the cuticle is organized, because the dermis, to which it is intimately attached, does not appear to be irritated by the connection, and makes no effort consequently to throw it off; secondly, because it is continually, though slowly, undergoing decay and renovation; and, thirdly, because it is liable, as will be hereafter seen, to a great variety of morbid changes, constituting an important class of cutaneous diseases. Neither vessels nor nerves have been traced into this membrane; and in the healthy state it is perfectly insensible.

The second layer of the skin, the most delicate of all, is the *mucous web*, for the discovery of which we are indebted to the celebrated Italian anatomist, Marcellus Malpighi, who first found it in the tongue, and subsequently in the common integument. It forms a thin, soft, semi-fluid lamella, destitute of vessels and nerves, but, like the epidermis, permeable to other bodies. The thickness of the mucous web varies, not only in different regions of the body, but likewise in the different races of mankind. Thus, it is much greater in the neck and scrotum than in any other part, and in the negro than in the European, in whom, from its excessive delicacy and difficulty of demonstration, several anatomists have been induced, though erroneously, to deny its existence. The precise structure of this substance is not known. Though destitute, apparently, of vessels and nerves, it is reasonable to presume that it is slightly organized, its vitality being probably on a par with that of the epidermis, to the inner surface of which it so closely adheres, both before and after it is detached from the corion. A recent French author, Dr. Gaultier, considers the mucous web as being composed of three distinct lamellæ, the external and internal of which are white, whilst the intermediate one contains the coloring matter. This notion, however, is not universally admitted by anatomists.

The mucous web is the seat of the coloring matter of the skin, which is white in the Caucasian, black in the African, yellow in the Mongolian, copper in the American, and tawny in the Malayan. In its essential nature, it is supposed to assimilate itself closely to hematosine, modified by a sort of secretory process. The opinion of Blumenbach and Davy, that it is nothing but carbon, is perfectly unfounded, as is also that of Gall, who considers it as analogous to the grey matter of the brain. This substance, whatever it may be, may be temporarily removed, or rather bleached, by immersing the skin of the negro in water impregnated with chlorine: in a few days, the black color returns with all its former intensity.

The fundamental portion of the skin, and consequently the most important layer of the three, both in structure and in function, is the *dermis*, also called the corion, or cutis. Unlike the cuticle and mucous web, it is a highly organized substance, most liberally supplied with vessels, nerves, and absorbents, and possessing the most extensive sympathetic connections, — as much so,



indeed, as any organ in the body. After a successful injection, the outer surface of the corion seems to consist of a uniform network of minute vessels, which are subdivided to an infinite degree of delicacy, and placed in such close proximity as to render it impossible to introduce the finest needle without drawing blood. The same test proves the equal abundance of nervous filaments, which are derived from the spinal axis and from the ganglionic portion of the fifth pair of the brain. The sensibility of the skin is well displayed in surgical operations, and in accidental wounds, in which the chief pain is always in the cutaneous textures, particularly in the corion. The absorbents are also extremely numerous; they are very easily injected; and, when this is accomplished successfully, the whole surface of the skin looks like a sheet of silver, their distribution resembling a network more than a regular ramification.

The corion, like the other lamellæ, already described, has two surfaces, an inner and an outer; the former of which is of a greyish white color, and hollowed out into innumerable pits, varying in size from the eighth to the twelfth of an inch. Of a rounded, oval, or angular shape, these pits, technically called *areolæ*, are placed close to each other, and are designed to receive granules of the subcutaneous fat, upon the quantity of which depends the sleek or wrinkled condition of the skin; they are absent on the back of the hand and foot. They do not entirely pierce the corion, but terminate each in a sort of cul-de-sac, the bottom of which is perforated by numerous oblique apertures, for the passage of hairs, vessels, nerves, and absorbents.

The outer surface of the corion is of a pale reddish flesh color, being much more vascular, as well as more smooth, than the internal. Numerous furrows, lines, or grooves are to be seen upon it, the size of which varies in different regions: in some situations they are so small as to be scarcely perceptible, whilst, in others, they are at once large and conspicuous. Specimens of nearly all the lesser varieties are to be found on the back of the hand, where they intersect each other so as to form various angles, from the most obtuse to the most acute. On the bulbs of the fingers, the grooves are arranged in concentric semi-circles; in the palm they are for the most part oblique, a few only being transverse.

Projecting from the external surface of the cutis, yet at the same time embedded in its substance, are the *cutaneous papillæ*, which were first described by Malpighi, in 1686, in his work, "De Externis Tactûs Organis," and the existence of which has since been generally admitted by anatomists and pathologists. They consist of a vast number of minute eminences, covered by the mucous web and epidermis, which thus defend them from the injurious contact of extraneous and hurtful agents. Varying in volume, from the sixth to the twelfth of a line, they are of a conical shape, their base being fixed in the substance of the dermis, the summit terminating in a blunt point. Generally speaking, these bodies bear a pretty close resemblance to the villi of the intestines, excepting that they are smaller, and of a more florid tinge. Like them, they are composed essentially of very delicate ramifications of vessels, nerves, and absorbents, connected together by cellular texture. Under ordinary circumstances, the papillæ are relaxed, and on a level with the dermis; but, when in action, they become erect so as to elevate the superincumbent structures. When the surface is chilled, as happens in the cold stage of intermittent fever, the corion shrinks, whilst the papillæ either continue unchanged, or contract less proportionally, and thus give rise to the appearance described under the name of *goose-skin*. The aggregate of these little bodies constitutes

what is called the papillary texture, which has been regarded by many as a distinct membrane.

The cutaneous papillæ, forming the true organs of touch and sensation, are most thickly planted where these functions are most acute and fully developed. They are very large and numerous in the palm of the hand and the sole of the foot, especially on the tips of the fingers and toes, where they have a concentric arrangement. In other regions of the body, they are irregularly disseminated; and, in many parts of the corial surface they are so indistinct that their existence is inferred rather from analogy than actual observation. These little bodies are often very conspicuous, as well as exceedingly painful, in inflammation of the skin, arising from the application of a blister, or some other irritating substance.

Besides the little bodies now described, the dermis contains an immense number of *sudorific glands*, so small as to be scarcely perceptible with the naked eye. Their structure is extremely vascular, and their form is that of a distended sac, with a tortuous, spiral canal, which winds its way to the surface of the epidermis, where it opens into a sort of pore. The existence of these glands, although suspected by some of the older anatomists, was first pointed out by Breschet and Vauzème, who are therefore justly entitled to the merit of the discovery. They exist in every part of the skin, but vary in size and form in different situations. In the palm of the hand and the sole of the foot, Gurlt describes them as being of a roundish, oval shape, and considerably larger than elsewhere; in the skin of the head, they are more oblong. In the ox, the glands are very small, spherical, and every where uniform in size and shape. The office of these little bodies is to secrete the sweat, and to convey it to the free surface of the cuticle.

The dermis, thus constructed, is a dense, firm, and resisting lamella, possessed of a very extraordinary degree of extensibility and elasticity. Considered in reference to its fundamental texture, it is found to be composed of white, greyish-looking filaments, which intersect each other in every conceivable direction, being much more closely interwoven on the outer than the inner surface of the membrane. By protracted boiling, the corion may be converted into a viscid, glutinous substance, consisting mainly of gelatine under some peculiar modification. A portion of the skin, however, always remains undissolved; and this, by being subjected to the influence of tannin, is gradually transformed into leather.

It only remains for us, in connection with the present topic, to present a rapid summary of the *sebaceous follicles*. Varying in size, between the smallest pin's head and a millet-seed, the number of these bodies is almost incredible. In a preparation deposited in the museum of the London College of Surgeons, by the late Mr. Chevalier, that gentleman counted not less than one hundred and thirty, on a surface of skin equal to the twenty-fourth part of a square inch. In their general arrangement and structure, these glands bear a striking resemblance to the follicles of the mucous membranes, being composed

each of a small pouch, the interior of which is lined by a process of the cuticle. (Fig. 91.) They are situated, principally, on the outer surface of the dermis, which presents a corresponding number of depressions for their reception; and they all open obliquely on the cuticle by appropriate outlets. (Fig. 92.) The sebaceous follicles are much more abundant and conspicuous in some regions than in others: they are particularly large and numerous on the nose, forehead, armpit, groin, margin of the anus, nipple,

Fig. 91.

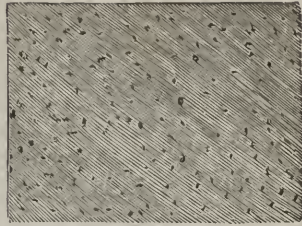


Sebaceous follicles and their ducts, double the natural size.

mons veneris, and pudendal lips, whilst in many other parts they are scarcely perceptible.

These glands secrete a thin, whitish, oily humor, which is designed to lubricate the cuticle, to render it soft, and to impart to it the suppleness which is necessary for the performance of its functions. It is insoluble in cold water, does not readily burn when exposed to the fire, and appears to be composed principally of ceraceous and oleaginous matter. By being retained too long, the humor becomes concrete, and may be squeezed out of the skin in the form of little worm-shaped bodies, each having a small, dark point, so as to look like a head.

Fig. 92.



Orifices of the sebaceous follicles on the surface of the skin.

We have already referred to the remarkable analogy between the structure of the cutaneous and mucous textures, and to the facility with which the one is sometimes converted into the other. Another subject, of still greater importance, in a practical point of view, is the sympathetic connection between the skin and other parts of the body. The principal relationships may be thus enumerated: 1, with the mucous lining of the stomach and bowels; 2, with the kidneys; and 3, with the serous membranes, especially the arachnoid and pleura. Examples, illustrative of the sympathetic connection between the skin and each of these organs, might be adduced without number; but they would be out of place in a work on pathological anatomy.

The different layers of the skin possess the power of reproduction, after they have been destroyed, but not all in an equal degree. The cuticle appears to be more readily regenerated than any other: it is perpetually in a state of decay and renovation, small furfuraceous scales dropping off in proportion as others form beneath them. In scarlet fever and erysipelas it often exfoliates in large pieces; yet, under such circumstances, it is generally very speedily reproduced, the new membrane being nearly as perfect as the one that was lost. The dermis and mucous web possess the power of reproduction in a less marked degree. Indeed, many deny that the latter is capable of being regenerated at all, the opinion being founded upon the erroneous statement that the cicatrices of the negro always continue pale. That this is the case occasionally, I am fully aware from my own examinations; but that this is universally or even generally true is what no one who has investigated the subject will believe. Let any one inspect the skin of a negro who has had small-pox, and he will find that, whilst some of the scars are lighter, others are fully as dark, if, indeed, not more so, than the surrounding skin. So likewise with the scars of wounds and old ulcers, provided there has not been too great a loss of substance. The dermis is perhaps less perfectly regenerated than either of the other lamellæ. We have already seen that it is abnormally thin and delicate, less flexible and elastic, and less capable of withstanding the effects of disease and the varying temperature of the surrounding atmosphere. Capillary vessels exist in great abundance, and are extremely liable to congestion on the slightest exposure; but as to sebaceous follicles, none whatever are to be found. Hence the skin, in such cases, is almost always unnaturally dry, and prone to become fissured. Are the sudorific glands, when destroyed, ever reproduced? This is a question which has not been determined by actual observation: conjecture would induce us to conclude that these little bodies shared the same fate as the sebaceous follicles.



## I. UNCLASSIFIABLE LESIONS.

*Keloides*, a disease first described by Alibert, is occasionally observed, though, as yet, I have not seen an instance of it. Its most common seat is on the neck, shoulder, and front of the chest, where it manifests itself by a small reddish point, about the size and shape of a grain of barley, which goes on increasing until it may attain the diameter of an inch or more. The centre of the tumor is generally somewhat depressed, its surface wrinkled, and its margin radiated, having some resemblance to the claws of a crab, whence its name. It is hard, resisting, and of a pale rose, or deep cherry-red color. On dissection, it exhibits a greyish, fibrous appearance, much like scirrhus of the female breast, the rays shooting out in different directions. The progress of this growth is very slow: it rarely ulcerates; and, in the majority of cases, it is unattended with any uneasiness, though at times it causes great pain and throbbing. Occasionally, as has been remarked by Alibert, it disappears, leaving merely a white, firm cicatrice. The most remarkable circumstance about this tumor is its disposition to return after removal. This may happen repeatedly, until the patient is at length worn out by it.

*Melanosis* of the skin has been sometimes observed, either alone or combined with other morbid products. The most common form in which it occurs is in that of small grains, of the size and color of a black currant. These little tumors, usually embedded in the dermoid tissue, are sometimes extremely numerous, giving the cutaneous surface a singularly tuberculated aspect: their occurrence is very rare, and they seldom ulcerate. Deposits of the same substance almost always co-exist in the subcutaneous cellular tissue and some of the internal organs. In the horse, this disease is of much more frequent occurrence than in man; it is also not uncommon in the skin of the ox, hog, and dog.

*Encephaloid* has never, I believe, been remarked as a primary disease of the skin, although it frequently extends to it from the subjacent textures, producing a red, spongy, tuberculated sore, more or less painful, and liable to bleed upon the slightest touch. This lesion, which it is unnecessary here more particularly to describe, is most apt to appear in the medullary sarcoma of the breast, testicle, and penis.

*Cartilaginous tumors* have been seen projecting from the skin, or growing within its substance. Mr. Mayo gives an account of a body of this kind, about the size of a chesnut, which he removed from the ham, where it had been long in forming. It seemed to have begun in the very centre of the dermis, was very painful when handled, and possessed all the physical properties of cartilage. Dr. Rayer, of Paris, has described a similar disease under the name of *mollusciform cancer*. In the interesting case reported by this physician, the tumors situated on the face, trunk, and extremities, were of a deep red color, hard, lenticular, and considerably elevated above the level of the surrounding skin. Frequently these growths possess a real carcinomatous character, exhibiting when cut, a greyish, dense, crisp texture, intersected by a great number of fibrous filaments, and yielding a small quantity of lactescent fluid on pressure. In size, they vary between a pea and a pigeon's egg: they are either rounded, conical, or pediculated, and occasionally they rest upon a large, flattened base. They often remain stationary for many years; and, although they are sometimes of a reddish color, they are for the most part of the same complexion as the skin.

A very rare affection of the skin has been recently described by Professor Warren, of Boston, under the appellation of *eiloides*, from its coil-like disposition.\* When first seen, it presents the appearance of a small elevation, similar to that from a burn, which goes on gradually increasing, without pain, heat, redness, or ulceration, until it acquires a great size, and affects the patient's health. In a drawing published by the able surgeon above mentioned, the disease is arranged like a triple coil of inflated intestine, the rolls lying in close contact, and being each four inches long, arising by a narrow base from the right side of the neck. The patient was a negress, fifteen years of age, whose health was otherwise disordered. Soon after its removal, the tumor reappeared in its former situation: it was again extirpated; and, showing itself a third time, it speedily destroyed the patient. Of the anatomy of *eiloides* nothing is known. The morbid growth, in all probability, takes its rise in the dermis, but in what particular portion of it has not been ascertained.

Besides these tumors, there is another disease of the skin, also extremely rare, which it will be necessary to notice before we conclude this branch of our subject. I allude to what is called *leporides*, a Greek term, literally signifying bark-like. The most common situation of this disease is the cranio-facial region, generally the forehead, cheek, or temple. Its progress is slow, and old age is its favorite period of attack. Consisting in an inflammation of the dermis, it makes its appearance in the form of a small, circumscribed speck, of a dirty color, which becomes covered with a very rough, brownish crust, resembling the bark of a tree. This falling off is soon replaced by another, of the same shape and color. Thus the disease is kept up for many successive years. Ulceration ultimately sets in, and the dermis exhibits a red, glossy surface, spicular, pitted, or granular, which throws out a thin, ill-looking pus. On examining the affected skin, it is found to be almost of a gristly hardness, its internal surface being studded with a number of small, whitish, rounded bodies, connected together by a dense, greyish texture. Very little pain attends this affection, and it often continues for many years before it manifests any malignant tendency.

A not uncommon affection of the skin is *hypertrophy*. Occurring most frequently in old corpulent subjects, it is sometimes congenital, and involves either the whole thickness of the organ, or some one or more of its component layers. The integuments of the nose are particularly liable to enlarge and thicken; the lesion is also sufficiently common on the neck, breast, arm, and back, forming rough, pendulous folds, several inches in length, which are usually somewhat darker than the skin in the normal state. Hypertrophy constitutes a prominent feature in the Barbadoes leg, in elephantiasis, in burns, and in chronic ulcers of the inferior extremity. The enlargement, in some instances, implicates nearly the whole cutaneous surface, by which the movements of the body are impeded, and the individual acquires a hideous aspect.

A remarkable case of hypertrophy of the several layers of the skin, admirably illustrative of the present subject, is recorded by Andral. The patient was a female, seventy-four years of age, who died of pulmonary phthisis. She had formerly had an ulcer on her right leg, but, for the last thirteen years, the sore had been cicatrized, while the limb had gradually acquired a most extraordinary size, being hard and swollen, and the skin rough, and of a yellowish brown, verging here and there upon black. On dissection, the

\* Surgical Observations on Tumors, p. 48. Boston, 1837.

thickened integuments were found to be composed of the following layers : 1, the epidermis ; 2, three subcuticular lamellæ ; 3, the papillary tissue ; 4, the dermis. All these parts, though intimately united, were perfectly separable, indurated, and irregularly thickened. The papillæ were remarkably elongated, turgid, and so crowded together that many of them had lost their characteristic features. Immediately over them, as just stated, were three distinct lamellæ, differing from each other in their texture, their color, and their consistence. The first, the most superficial, was of a greyish hue, and presented a true horny firmness : this stratum, to which Dr. Dutrochet has applied the appellation of the horny layer, exists only as a rudiment in man, but is very perfectly developed in the inferior animals. The second lamella was of a greyish, brown, or black complexion, reticular in its structure, and composed of exceedingly delicate filaments, crossing each other in every possible direction. This layer, Andral supposes to be analogous to the colored layer in negroes. Lastly, there was a third stratum, placed immediately beneath the preceding, excessively delicate, of a white, undulating appearance, and made up of a cellulo-fibrous substance : it was closely connected with the papillary tissue, and was analogous to the epidermic layer described by Dutrochet.

The hypertrophy may be seated principally in the papillæ. The affection is sometimes congenital, sometimes accidental, and is met with in various degrees of intensity. When it accompanies or follows burns, blisters, and chronic eczema, the bodies in question often attain a most extraordinary development ; their volume is five or six times above the natural standard ; they are of a pale brownish color ; and they present an uneven, mammillated appearance, not unlike the pile of coarse plush, which is rendered particularly conspicuous when they are plunged in warm water. The dermis, in these cases, is often very much thickened, as well as indurated, and is covered with thin micaceous scales, which are easily rubbed off, and constantly reproduced.

Hypertrophy of the epidermis is best seen in ichthyosis, — a disease which will be particularly described under the head of squamous disorders, amongst which it has been classified by some highly respectable European authors. A corn is a species of hypertrophy of the cuticle, on a small scale, which it will be in place to notice here.

*Corns*, technically called *tyloses*, are hard, dry, insensible callosities, occurring mostly on the lateral and dorsal surfaces of the toes, especially the first and last : they are also sometimes seen on the sole of the foot, between the fingers, and on the flexor tendons in the palm of the hand in working people. Their morbid anatomy consists in inflammatory irritation of the cellular layer of the dermis, eventuating in the effusion of lymph, and the consequent thickening and induration of the cuticle. The texture of a corn, especially when old, is lamellated, and almost always more firm at the centre than at the circumference. By cutting away its superficial layers, a sort of internal nucleus is exposed, which has a whitish, horny looking appearance, and often occupies a considerable portion of the substance of the dermis : it is generally more or less moist, and is now and then surrounded by a minute ecchymosis.

The form of these callosities, although variable, is usually rounded, and their size rarely exceeds that of a five cent piece. Some corns are movable, others fixed ; and cases occur, in which they have a sort of radiating root, extending deeply into the subjacent cellular texture. Their remote cause is pressure, commonly that of a shoe, which, if continued for any



length of time, inflames the cutis, and renders it excessively painful. The complaint is more frequent in females than in the other sex, and in the rich than in the laboring poor.

*Warts* are hard, insensible excrescences, of a conical form; their surface is hard, tuberos, fissured, and almost indolent; in size, they seldom exceed a common pea; in color, they are several shades darker than the surrounding skin; sometimes they are movable, sometimes fixed. This kind of vegetation is of a radiated structure, and composed of elongated, vascular papillæ, encased in the epidermis. It is the result, apparently, of a slow chronic irritation, and often occurs in immense numbers on the hand and face of young persons. In the latter situation, warts are apt, in the more advanced periods of life, to take on carcinomatous action, either spontaneously, or from being pulled. In the young, they often disappear of their own accord.

The skin is sometimes the seat of *horn-like excrescences*. These productions occur principally in those parts of the body where sebaceous follicles abound, and hence they are more frequently observed on the cranio-facial region than in any other. In seventy-one cases collected by Dr. Villeneuve, twenty-six were seated on the scalp, five on the nose, two on the cheek, one on the lower-jaw, four on the chest, four on the back, three on the anus and penis, four on the buttocks, twelve on the thigh, two on the knee, two on the ham, one on the leg, and three on the foot. They have also been seen on the scrotum, the back of the hand, and on the pavilion of the ear. Although the reverse has been asserted, they appear with nearly equal frequency in both sexes, during the period which intervenes between the ages of forty and seventy: in a few instances they have been met with in young children.

The magnitude which some of these excrescences attain is surprising. (Fig. 93.) Bateman states that there is one in the British Museum, which is eleven inches in length by two and a half in circumference. From three to six inches is by no means an unusual size. Their direction is generally somewhat spiral, twisted, or bent; and, in their appearance, they often bear the closest resemblance to the horn of the sheep, being marked by rough circular rings with intervening depressions, indicative of the successive steps of their development. In color, they vary from a dingy yellow to a

Fig. 93.



A remarkable horny excrescence growing from the scalp.

dark greyish. They are of a firm, cartilaginous consistence, more or less flexible, and conical in their shape, being large at their origin, and tapering to their terminal extremity; when burned, they exhale a characteristic animal odor. Now and then their surface is imbricated, knobbed, or covered with small, pearl-colored scales. Internally they have occasionally a lamellated arrangement, as in Fig. 94.

Fig. 94.



A section of the horn, showing its lamellated structure.

These excrescences, as before intimated, are generally connected with the sebaceous follicles, and are directly traceable to chronic inflammation, such as is produced, for example, by a burn, a wound, or a contusion. When first observed, they are quite soft, transparent, and invested by a distinct cyst, which, extending over their base, is gradually and insensibly lost upon their trunk. In the course of a few weeks, they become hard, assume a darker hue, and thus acquire the properties of the horny tissue. Their growth, on the whole, is very slow, from three to five years elapsing before they reach any considerable size. When they drop off spontaneously, as they have been known to do in a few instances, they invariably sprout out anew, pursuing the same course as their predecessors. The same thing happens when they are extirpated without the precaution of destroying the cyst from which they arise. Several such excrescences are occasionally observed in the same individual.

The production of *gangrene* of the external integuments is by no means a rare occurrence. It is observed in different situations, and arises from a variety of causes, some of which seem to have a preference, so to speak, for this over other structures. Occasionally, therefore, it may occur as an original idiopathic affection; but more generally it is the result of specific inflammation, or of inflammation depending upon external violence. Of the former, we have an example in malignant pustule, in phlegmonous erysipelas, and in common carbuncle. As illustrating the present subject, we shall describe only one of these lesions; and, as being more interesting than the rest, we shall select malignant pustule,—a disease which seems to owe its origin to the operation of some septic agent.

*Malignant pustule*, *charbon*, or *anthraxion*, as it is variously denominated by foreign authors, although very rare in this country, is often observed in certain parts of France, particularly in Lorraine, Burgundy, Provence, and Languedoc. In the low marshy districts of these regions, the cattle are obliged to subsist upon bad and vitiated provender; and the consequence is, that many of them are seized with dynamic fever, accompanied with gangrene of the skin. In the summer season, indeed, the disease sometimes prevails epidemically. By dissecting animals that perish in this way, or by merely touching their hides or hairs, the disease is readily propagated to the human subject. There are numerous facts, also, which prove that malignant pustule may be communicated by introducing the hand into the rectum, vagina, and throat of cattle affected with this malady; and similar results are often produced by touching the blood, the secreted fluids, and the excrements, or by injecting the former into the veins.

Shepherds, herdsmen, tanners, and butchers are most subject to the disease; and the parts most liable to be affected are such as are habitually uncovered, as the face, neck, and chest, together with the arms and hands, the legs and feet.

With regard to the anatomical characters of this disease, with which we are chiefly concerned on the present occasion, they may be divided into three

stages, each of which is marked by some peculiarity of feature, worthy of separate consideration.

The time which elapses between the inoculation and the development of the disease varies from three to eight days. It commences in a small circular prominence, the centre of which soon degenerates into a minute vesicle, about the size of a millet-seed, without heat, tension, or redness. As this vesicle enlarges, it assumes a brownish color, and, when ruptured, discharges a few drops of a yellowish bloody serosity. At intervals, a good deal of itching is experienced, accompanied occasionally with a peculiar stinging sensation. This period lasts from twenty-four to forty-eight hours, and constitutes the first stage of the disease.

The second stage, which rarely endures beyond a few days, is characterized by the development of a hard, movable, circumscribed tumor, of a yellowish livid color, with a rough granulated surface. This, in a short time, becomes surrounded by a purple, glossy-looking areola, on which numerous phlyctenæ, containing a reddish serosity, are situated, which quickly run into each other. The disease, having penetrated the entire thickness of the dermis, now invades the subjacent cellular tissue; and the centre of the little tumor presents all the features of an eschar.

In the third stage, the gangrenous point rapidly extends, and the enlarging areola rises above the eschar, causing its centre to be depressed. The surrounding surface is tense, emphysematous, and of an erysipelatous red; the acrid heat and stinging are succeeded by a sense of weight and numbness; the disease burrows deeply into the cellular texture; and the mortified skin is of a blackish color, and a firm, leather-like consistence. From twenty-four to seventy-two hours is the usual duration of this stage, which is commonly attended with high constitutional excitement. The size of the slough, at this period, varies from six lines to one or two inches.

But it is not always that malignant pustule observes the regularity here ascribed to it. The different stages often succeed each other in rapid and indistinct succession; and the disease has proved fatal in less than twenty-four hours after its commencement. When it terminates favorably, a red inflammatory circle appears, which serves as a line of demarcation between the dead and living parts.

From experiments performed in 1816, by M. Berthélemy,\* a professor in the Veterinary School at Alfort, near Paris, it appears that the ichorous matter furnished by malignant pustule retains for a long time its nocuous properties. Having put some of the fluid in a corked vial, he preserved it for about eleven months, when he inserted a portion of it into the skin of a stout, healthy horse. The consequence was, a gangrenous tumor, having all the characteristics of malignant pustule, and which, notwithstanding the small quantity of virus, killed the animal in three days.

In *ordinary gangrene*, or in that variety of it which arises from excessive inflammatory action, the color of the skin changes from a florid red to a darker shade, acquiring, during the progress of the disease, a purple, livid, or blackish hue. Concurrently with this change of color, the affected part undergoes a decided alteration of structure. It feels soft, boggy, and emphysematous, and the cuticle is raised into numerous phlyctenæ, filled with bloody looking serosity. When completely deprived of vitality, the skin sometimes becomes a shade or two lighter, and is detached in soft, greyish, inelastic strips, which are often bathed with a thin, ichorous, and offensive fluid. "The ash-colored

\* Dictionnaire de Médecine et de Chirurgie Veterinaire, t. iii., p. 713.



slough seems to occur most frequently in skin which is moister, and the black-colored, in skin which is more dry than common."

There is a singular species of cutaneous gangrene, to which, from the peculiarity of its appearance, we may apply the term *white*. It generally comes on without appreciable cause or preliminary symptom, occurring in irregular shaped patches, from one to three inches in diameter. The sloughs are of a dead milky color, and of a hard, dryish consistence, yielding little or no moisture on pressure. Any portion of the body may be the seat of this affection; but it would appear that the arms, back, and chest, are the parts most frequently implicated. The true nature of the lesion is still involved in mystery.

The *sebaceous follicles* do not seem to be very prone to disease. When inflamed, they augment in volume, their capillaries are injected, and they pour out a preternatural quantity of matter, which, in time, forms an unctuous, tenacious covering, not unlike a layer of semi-concrete wax. If it be allowed to remain, this substance sometimes acquires the appearance of thick, imbricated scales, of a blackish color, which may be mistaken for those of ichthyosis, from which they differ, however, in being much more easily detached. Under this accidental covering, the skin is of an unusually red color, and the mouths of the follicles are either very much enlarged, or obstructed with hard sebaceous matter. This disease, which is almost peculiar to youth and adults, may last for years, and the secretion which attends it is occasionally of a sero-purulent nature, especially in obstinate cases.

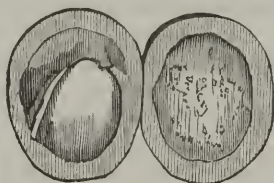
Another effect which sometimes results from inflammation of the sebaceous follicles, is the formation of *encysted tumors*, containing meliceric, atheromatous, or steatomatous matter, or several of these substances conjoined, as in Figs.

Fig. 95.



A sebaceous follicle in a state of incipient enlargement, its orifice being distended with meliceric matter.

Fig. 96.



A sebaceous tumor laid open to show the thickness of its cyst.

95 and 96. The mouth of the follicles being obstructed, and the natural secretion going on, their cavity gradually expands, until the sac acquires, in some instances, the volume of an apple, or even of a cocoa-nut. The parietes of these tumors are occasionally quite hard and thick, like the dura mater; and cases are observed, though very rarely, in which they are ossified, or transformed into fibro-cartilage. (Fig. 97.) Externally, they are rough, and connected to the surrounding parts by cellular tissue; internally, on the contrary, they are generally smooth and glistening. Small sacs are sometimes observed in the interior of these tumors; but these are rare, and I have never met with them.

Fig. 97.



Sebaceous tumor, with an ossified cyst.

In their shape, these tumors are for the most part globular, and they are found more frequently, by far, on the face and scalp than in any other situation. Their number, although usually small, is sometimes very great. In a case which fell under my notice, nine years ago, I counted several hundred on the head and trunk of a man

forty years of age. Most of them commenced when he was quite young, soon after bathing in cold water. The tumors were of the meliceric kind, and

the largest were about the volume of a hen's egg ; the surface of many was uneven, and partially incrustated with hard, sebaceous matter of a dark color.

Tumors of this kind are commonly somewhat movable, though in this respect much depends upon their age and location. Sir Astley Cooper considers them as in some degree hereditary ; and his opinion is strongly corroborated by an interesting case which fell under my own observation in 1840. In this instance, the disease existed upon the scalp of a young woman of twenty-seven, and upon that of her father, a paternal aunt, and her paternal grandmother. The tumors were from four to seven in number, and varied in volume from a marble to a walnut. They are usually unattended with pain, have no malignant disposition, and the skin covering them, although occasionally streaked with large vessels, generally retains its natural character. Sometimes the contents of these tumors are thin, watery, and exceedingly offensive. In other cases, short hairs, very soft, and provided with well-formed roots, are found in them. (Fig. 98.)

The sebaceous follicles, instead of secreting their accustomed humor, occasionally deposit a hard, *calcareous* substance. Meckel\* relates the case of a young lad, the skin of whose buttocks was completely studded with small concretions of this kind ; and similar bodies have been repeatedly found in the sebaceous follicles of the forehead and root of the nose. Their chemical composition has not been determined, but it is probable that they consist mainly of phosphate and carbonate of lime, agglutinated by a minute quantity of animal matter.

The skin is sometimes the seat of *hemorrhage*. The only form to which I shall allude, is what is called *purpura*. Of this, three varieties may be described, — the *petechial*, the *simple*, and the *complicated*, or, as it has been denominated by some, the *hemorrhagic*. These varieties are referable principally to the extent, form, and situation of the effused blood ; and it is important to remember that they may all occur simultaneously or successively in the same individual. No period of life is exempt from this disease. In a few instances it has been observed soon after birth.

In the *petechial* species, the blood is collected in minute isolated points, situated immediately beneath the cuticle : they are of a circular shape, from the fourth of a line to a line in diameter, seldom or never elevated above the surrounding surface, and usually of a pale color, though frequently of a deep red or purple. The lesion, generally concomitant of plague, typhus, scurvy, and dysentery, is almost always most conspicuous on the chest, back, and inside of the arms and legs. I have recently seen a case of this kind in a young man, who died of enteritis, attended with profuse bleeding from the nose and bowels.

In *simple* purpura, the parts principally affected are the extremities, especially the inferior. The effusions take place slowly and successively, so that, while some are fading and disappearing, others are forming and increasing. They are at first of a vivid red color ; but, in a few days, they acquire a deeper and more livid hue ; and, in proportion as the blood is removed by absorption, they become greenish, then yellowish, and ultimately vanish altogether. They are also of a circular shape, but much larger than in the *petechial* variety, being from one to eight lines in diameter, and seated between the cuticle and mucous

Fig. 98.



Cyst of a sebaceous tumor, with hairs in its interior.

\* Voigtet's Handbuch der Path. Anatomie, Halle, 1804. Erster Band, p. 85.

network, or in the dermis and cellular tissue, or in both these situations simultaneously. The duration of the individual blotches is from six to ten days; of the disease from one to twelve months. Cazenave and Schedel refer to a case in which the effusions succeeded each other at short intervals for more than two years: the patient was a female, forty years of age, who was subject to dysmenorrhœa, and of an unusually plethoric habit.

The essential difference between the preceding and the *complicated* variety of purpura, consists in the effusions in the former being confined to the external surface; whilst, in the latter, they not only occur in this situation, but also in other parts of the body, especially beneath the mucous and serous membranes of some of the principal organs. The blotches are likewise of a deeper color, larger, and less regular in their shape, and in many cases they bear a striking resemblance to the ecchymoses which follow a bruise or contusion. Indeed, the slightest pressure is frequently sufficient to produce them, particularly in parts where the skin is very thin and the cellular tissue abundant. When the effusion is considerable, the cuticle is sometimes elevated into small bladders, which, on breaking, give vent to black, semi-fluid blood. This occurrence, however, is extremely rare, and, in the generality of cases, there is not the slightest elevation. This variety of purpura usually begins on the legs and thighs, from whence it gradually extends over the trunk and arms. The hands and face almost always escape.

Are the above effusions the result of a rupture of the vessels, or are they caused simply by exhalation? Of the two, the latter supposition is, perhaps, the more correct; at all events, the researches of Fournieux and others have failed in detecting any communication whatever between them and the neighboring vascular branches. The subject, however, requires further investigation; for the morbid anatomy of this affection, to say the least of it, is extremely imperfect, and does not enable us to offer any satisfactory explanation, either in regard to the nature of its predisposing causes, the character of the primary local lesion, or of its complications.

Besides the varieties now described, there is another form of hemorrhage, in which the blood oozes from certain regions of the cutaneous surface, in the same manner as it sometimes does from the mucous membranes. The discharge is most frequent in hysterical girls, about the age of puberty, and is usually *vicarious* of some similar natural or morbid state in a remote organ, which is almost always the uterus. The skin appears as if covered with a sort of dew, the blood being effused in minute globules, which, on being wiped away, presently exude afresh. The exhalation, especially when it occurs in females, is commonly periodical, and shows itself simultaneously or successively at a number of points, as the face, chest, umbilicus, fingers, toes, the palm of the hand, and the sole of the foot.

## II. CLASSIFIABLE LESIONS.

1. *Exanthematous Diseases*. — The exanthematous diseases are characterized by the occurrence of more or less inflammatory redness in the superficial portion of the dermis, which momentarily disappears under the pressure of the finger, runs its course in from two to six days, and is always preceded and accompanied by constitutional symptoms. The efflorescence is sometimes circumscribed, sometimes diffuse, and occasionally, as in scarlatina, covers the whole body. The usual termination of these affections is by resolution and desquamation. Several of them are of a contagious nature, and occur only



once in the same person. The diseases included in this group are roseola, urticaria, erythema, rubeola, scarlatina, and erysipelas.

*Roseola* is characterized by rounded, circumscribed spots, closely set together, of a deep red color, and from four to six lines in diameter. These patches, which disappear in the course of twenty-four hours, are almost always dependent upon gastro-intestinal derangement, and are rarely followed by any appreciable desquamation. The disease is not contagious: it is commonly marked by febrile disturbance, and often covers only a part of the body, as the neck, trunk, or extremities. It may occur at any period of life, as well as in both sexes, but is most frequent in women and in children. Roseola seems to be seated in the most superficial portion of the dermis, and to consist in a transient injection of the cutaneous capillaries. There is a singular variety of this disease, in which the spots are arranged in the form of rings, the centres of which retain their normal color: two or three such rings, of variable breadth, are sometimes situated the one within the other.

*Urticaria*, familiarly called "nettle-rash," is a non-contagious inflammation, the duration of which varies from a few days to several months. It appears in the form of prominent wheals, of an irregular shape, paler or redder than the surrounding skin, usually of short continuance, and always attended by a peculiar stinging sensation. In severe cases, the wheals are often very large, hard, and deep-seated, involving the subjacent cellular tissue with a tense, sore, and tumid state of the skin. The favorite situations of the eruption are the shoulders, loins, fore-arms, thighs, and knees. The disease frequently changes its position, appearing at one time here, and at another there; as to the individual patches, their duration seldom exceeds twenty-four hours. The anatomical characters of urticaria are imperfectly understood.

*Erythema* is an uninfectious exantheme, the distinguishing traits of which are superficial blotches, of a deep florid color, lasting from a few days to a fortnight, irregular in their shape, and varying in diameter, from several lines to many inches: the redness momentarily disappears under the pressure of the finger, and is seldom attended with any appreciable swelling. The disease is most common in females, and young, weakly persons; and the neck and chest, together with the superior extremities, are its most frequent situations. Erythema occasionally occurs in regularly circumscribed spots, of a circular shape, and about the size of a split pea: they are slightly prominent, of a bright florid color at the commencement, and subsequently of a violet hue, especially at their centre. This constitutes the *papular* variety of Willan. Another form is the *nodose*, in which the patches, also considerably elevated, are of an oval shape, and from a few lines to an inch in diameter. In other cases, the redness is annulated, marginate, or diffused over a large extent of surface. In whatever form it may appear the blotches seldom suppurate, nor are they always followed by desquamation of the cuticle.

*Rubeola* is a contagious epidemic malady, occurring for the most part in young children, during the winter and vernal months. It rarely attacks the same person more than once. The eruption breaks out about the fourth day from the commencement of the indisposition, and is first seen on the forehead, face, and neck, from which it gradually spreads over the rest of the body. It consists of small, red pimples, which are slightly elevated above the surrounding level, and look very much like so many flea-bites. In the progress of the disease, the little speck becomes more prominent: their color is heightened, and their diameter expands, until at length, coalescing with each other, large patches are formed, of an irregular semi-lunar shape, with small intervals of sound skin between them. A minute vesicle occasionally appears at the centre

of each spot, filled with a whitish, watery fluid. The swelling of the skin is commonly very trifling, and the redness, which attains its acme in about twenty-four hours after its first appearance, has always a shade of purple. The eruption lasts from three to four days, declining pretty much in the order in which it began, and is constantly followed by a branny, scurf-like exfoliation of the epidermis.

Rubeola, it would seem, is propagable by inoculation. Dr. Home, of Edinburgh, declares that he has repeatedly succeeded in communicating the disease in this way; and similar results are said to have followed the experiments of Dr. Speranza, of Italy. Dr. Chapman, on the other hand, denies this; asserting, on the authority of numerous trials both with the blood, tears, and naso-bronchial mucus, that he has never been able to impart the affection by this expedient. The question may therefore be considered as still undecided. Meanwhile, no doubt can remain as to its contagious character.

The fifth disease to be noticed under this head is *scarlatina*. Like rubeola, this is a contagious affection, coming on from three to six days after exposure. Attacking children in preference to adults, it often prevails epidemically, especially in winter and spring, and in one form at least is a source of immense mortality. This form is the malignant, so termed from its being attended with great depression of the powers of life, and from being complicated with violent inflammation of the palate, tonsils, and pharynx. The efflorescence breaks out from twenty-four to forty-eight hours from the moment of the invasion of the disease, first on the face and neck, then on the trunk, and finally on the extremities. It consists of myriads of small red points, so closely grouped together that the whole surface exhibits a red scarlet hue, and feels rough to the touch, as if fine sand were strewed over it. The color is generally most intense in the evening, and has been compared, not unaptly, to that of a boiled lobster: it reaches its height about the end of the third day, begins to fade on the fifth, and disappears entirely about the seventh. With this efflorescence there is usually violent heat of the skin, with a sense of fulness, and more or less itching; and, in many cases, the whole mouth and tongue, together with the throat, are of a deep, fiery color, evidently from an extension of the disease. Small vesicles sometimes appear on the eruption, resembling those that are occasionally noticed in rubeola, and containing a thin, sero-lymph fluid: they seldom continue longer than four days, and it is not improbable that they are produced by some disorder of the sebaceous follicles. Their number is sometimes immense. In the case of a young girl, twelve years of age, who came under my observation three years ago, the whole body was literally covered with them: they were about the size of a common pin-head, of a whitish color, and filled with a thin, tenacious fluid, which seemed to be gradually absorbed, as none of the little vesicles burst and discharged their contents. The desquamation, which is generally lamellar, begins about the seventh day, and is accompanied by disagreeable itching.

The last disease that we shall describe under the present group is *erysipelas*. In the United States, as well as elsewhere, this is an extremely common affection: it may be idiopathic or traumatic, epidemic or sporadic; and is supposed to be sometimes contagious. It spares no period of life. I have seen it in new-born infants, in middle age, and in decrepitude. It occurs more particularly in persons of a deteriorated, worn-out constitution, and is usually preceded, as well as accompanied, by symptomatic fever. Although erysipelas may appear on any part of the body, the head, face, and legs are out of all proportion its most frequent situations. Of this disease, there are two important varieties, the simple and the phlegmonous.

The first, which has its seat exclusively in the dermoid tissue, is characterized by diffused redness, with slight swelling, increased heat, and a tingling, burning sensation. The discoloration is of a deep cherry hue, and disappears momentarily under pressure. When the inflammation runs very high, the cuticle is elevated into vesicles, varying in size from a pin-head to a hazelnut, isolated or conglomerated, and containing a thin, straw-colored, or bloody serosity. The vesications usually appear within the first forty-eight hours, break in a day or two after, and are replaced by thin, hard, yellowish crusts, which subsequently blacken. In milder cases, the disease subsides much sooner: the redness, about the third or fourth day, assumes a dusky yellowish tinge, the swelling diminishes, the skin becomes wrinkled, and the epidermis is detached in small bran-like scales. Few or no vesicles are observed. This variety is sometimes erratic, that is to say, it suddenly disappears at one point, and attacks another, leaving no other traces than a slight desquamation.

In the *phlegmonous* variety, besides the phenomena above described, there is often great swelling of the subcutaneous cellular texture with infiltration of acrid and bloody serosity, suppuration, or sloughing. This form of the disease I have seen most frequently about the eyelids, and the legs, in old, intemperate subjects. Great constitutional disturbance usually attends: the affected part is exceedingly painful, and the dermoid and cellular tissues often slough in large patches, the latter coming away in dark-colored, dirty-looking shreds.

2. *Pustular Diseases.* — Pustules are produced by inflammation of the dermoid textures, terminating in an effusion of matter, which elevates the cuticle into small, circumscribed tumors. The genera comprehended in this order are acne, sycosis, ecthyma, porrigo, impetigo, vaccinia, variola and varicella. Some of these affections are acute, and others chronic; some are contagious, and others not; some are discrete, and others confluent. Differing as they do in these particulars, they all resemble each other in the fact of their terminating in a scabby incrustation, varying in thickness and density in different cases, and leaving, on dropping off, the surface to which it adhered, for some time, of a red color.

*Acne* is a chronic inflammation of the sebaceous follicles, lasting from several weeks to as many years, characterized by the presence of small, isolated pustules, the most common seat of which is the upper and back part of the trunk, though they are often seen also on the forehead, nose, chin, and temples. The limbs are seldom affected with them. The disease is equally frequent in both sexes, and is particularly apt to occur about the age of puberty. The skin of the affected region looks tense and unctuous, the follicles are enlarged, their parietes are engorged with blood, and their orifices are marked by black points, giving the disorder its characteristic aspect. Each pustule is encompassed by a red areola; matter, mingled with the natural secretion, gradually forms in its interior; and, after a short time, a thin scab appears, which, on falling off, exposes a florid and slightly elevated prominence, that gradually sinks to the level of the surrounding surface. Small scars sometimes remain; and, in old chronic cases, the skin is often quite hard, and exhibits a rough, granulated appearance, with varicose enlargement of its vessels.

Seated in the sebaceous follicles, and closely allied to the disease just described, is *sycosis*, the mentagra of Willan and Alibert. Its distinguishing feature is the successive evolution of numerous sharp-pointed pustules, scattered over the hairy scalp, upper lip, the chin, lower jaw, and side of the face, occurring usually in adults, and preceded by considerable redness of the affected part, with a sense of heat and tension. Red vesicles soon become



visible, which, by the third day, assume a pustular form, standing out like circumscribed elevations, the summits of which grow white, and are gradually filled with pale yellowish matter. The prominences subsequently increase a little in size, and, when fully developed, are as big as millet-seed. Between the sixth and seventh day, each pustule bursts, its sides shrink, and a slight discharge takes place, which dries into a brownish crust, that is feebly adherent to the skin, and insensibly lost in the adjacent epidermis.\*

When the pustules are very numerous, they sometimes coalesce, and the inflammation is then apt to extend to the subjacent cellular texture, which is rendered hard and painful, and exhibits all the appearances of a true phlegmonous swelling. The pustules themselves are quite large: they rest upon a red, tuberculated base, often contain bloody matter, and are covered with thick, dirty-looking incrustations. The skin is sometimes very much altered, and sprouts out in the form of moist, vegetating excrescences. Arrived at this pitch, the disease is extremely intractable, and presents a most loathsome aspect: the hair falls out, and the part is constantly bathed with a thin, sero-sanguinolent fluid, often excessively acrid in its character. Fortunately, this affection is very rare in this country, and seldom attains the height it does in continental Europe.

The disease next in order is *ecthyma*, which is closely allied to *rupia*, being, indeed, considered by some merely as a variety of it. It is an inflammatory affection of the dermoid texture, non-contagious, and characterized, at its height, by *large*, rounded pustules, usually distinct from each other, and resting upon a hard, florid base. All parts of the body are liable to be affected; but the regions most frequently involved are the neck, chest, and shoulders. The eruption generally begins by small, reddish elevations, which rapidly augment in size, and become filled, in the course of a few days, with sero-purulent matter, the base, in the mean time, extending in diameter, and exhibiting a bright scarlet hue. In this state, the larger and more mature pustules have a conoidal shape, are hard and painful on pressure, and bear a close resemblance to small boils, their size being between that of a lentil and a big pea. A pseudo-membranous substance is also frequently to be distinguished in their interior, particularly towards their centre.

In from three to five days, the contents of the pustules escape, and congregate into thick, whitish, adherent scabs, the disengagement of which, occurring at indefinite intervals, leaves the part of a red, livid color, each spot being from four to eight lines in diameter, and marked at its centre by a minute, superficial cicatrice. Acute *ecthyma* is often accompanied by severe lancinating pains, and has only one crop of pustules; whereas the chronic form of the disease, which is by far the most common, has always a continued succession of them. Some of the pustules occasionally terminate in ulceration, producing ill-conditioned, painful sores, attended with a sanious bloody discharge, and followed by thick, dark-colored crusts.

*Impetigo* is a non-contagious, chronic disease, which is exceedingly prevalent in this country, in young children during the period of dentition, especially in such as are of a scrofulous habit. It is most frequently observed on the face and legs, and next in order on the forehead, neck, and trunk. In some instances — and these are not infrequent — the disease covers all these parts simultaneously, or gradually travels from the one to the other. The pustules are *small*, irregularly circumscribed, with only a slight elevation of the cuticle, and terminate in thick, rough scabs. The disease is accompanied and

\* Rayer's Treatise on Diseases of the Skin, p. 481. Second edition. London, 1835.

produced by inflammation of the part affected, which continues for an indefinite period, and causes considerable enlargement of the capillary vessels, particularly of the veins. At first, the eruption is vesicular; but, like that of small-pox and other kindred disorders, it becomes pustular, the elevations being distended, in a few days, with sero-purulent matter, which is often poured out in great abundance, and rapidly hardens into thick, semi-transparent, friable scabs, resembling fragments of dried honey. Occasionally, the incrustations, instead of being of a clear yellowish color, are of a light greenish, brown, or mahogany hue. The scabs having fallen off, the denuded skin is observed to be of a deep red complexion, slightly fissured, abnormally thick, tender on pressure, and to exude a considerable quantity of sero-purulent matter.

Impetigo appears under two principal varieties of forms, — the small pustules that characterize it being, in the one, irregularly disseminated, with healthy or more or less inflamed intervals, — in the other, disposed in groups, generally of an oval shape, and resting on a tumid, rose-colored base. Each of these varieties is acute or chronic, according as there is only a single crop of pustules, or a successive reproduction. Closely as this disease resembles ecthyma in many of its features, it can always be easily distinguished from it by the *smaller* size of its pustules, their mode of development, and the *lighter* color of their base.

The term *porrigo* is applied to a chronic inflammation of the skin, essentially contagious in its nature, and characterized principally by the appearance of its scabs, which are of a bright yellow color, very dry, thoroughly adherent, and of a circular shape, with a central, cup-like depression, and thick, prominent, and inverted edges. The most usual seat of the disease is the scalp, from whence, however, it often extends to the forehead, temples, chin, eyelids, and other regions, until, in some instances, it covers almost the entire body. Occurring indifferently in both sexes, at all seasons of the year, and at all periods of life, it is most common in infancy and childhood, and is always of indefinite duration, lasting at one time only a few weeks, at another a number of months, and, in a third series of cases, perhaps several years. Alibert describes five varieties of porrigo, Willan not less than six. These divisions are certainly uncalled for, as they differ from each other merely in the intensity of the morbid action, the location of the disease, and the distribution of the pustules. The mildest form of the eruption, and one which is extremely common in this country, affects the head and face of infants, and is usually known by the name of *crusta lactea*.

Porrigo, in whatever form it may appear, or wherever situated, always commences in very small pustules, scarcely rising above the surrounding surface, and covered, from the very first, with a thin yellowish crust, with a minute central pit. Examined at this period, the pustules are found to contain a drop of sero-purulent matter, which, instead of escaping, as happens in most other kindred diseases, always remains, and dries in their interior. The scab, manifesting itself, as we have just seen, almost simultaneously with the eruption, goes on increasing until it reaches the diameter of a ten cent piece: its central depression in the mean time becomes remarkably distinct; and, in the course of a week or so, it acquires all the characters above assigned to it. When the pustules are confluent, the incrustations often cohere, and are detached in large yellowish masses, leaving the cuticle tender, red, elevated, and marked with deep lines. Excessive itching generally attends this disease, and the scabs are often reproduced in great numbers and with astonishing rapidity.

The odor of the scabs is peculiar. Alibert and Rayer state that it resembles that of the urine of the cat. When the scabs are softened with emollient poultices, the smell changes, becoming faint, sickening, and a good deal like that caused by boiling bones with their ligaments. The substance of which they are composed has been carefully analyzed by Thenard, who found that one hundred parts contain seventy of coagulated albumen, seventeen of gelatine, five of phosphate of lime, and eight of water.

Porri<sup>go</sup> is supposed by some to be seated in the piliferous follicles, — an opinion which seems so much the more plausible, when it is remembered that the disease principally occurs in those regions which abound in these structures, and that a hair frequently occupies the centre of each pustule. However this may be, the hairs are always considerably affected: they become dry, stunted in their growth, and many of them fall off. This is particularly apt to take place in chronic porri<sup>go</sup> of the scalp, the *furfuraceous variety* of Bateman, which is almost always attended with permanent baldness. Occasionally, the piliferous follicles remaining, a new crop of hairs is produced, which are thin, white, and downy.

*Vaccinia*, usually called cow-pox, is a contagious disease, which is transmitted by inoculation from one individual to another, and which is characterized by the development of large, multilocular, pearl-colored pustules, surrounded by an erythematous areola, and succeeded by a brownish scab, which falls off about the twenty-fifth day, leaving a pitted scar. Three well-marked stages are to be observed in the progress of this affection.

The first stage commences on the fourth day after the insertion of the virus, and terminates on the ninth. At this time the true vaccine inflammation first manifests itself, and the puncture, which until now resembled a mere scratch, assumes a pale rose color: it is somewhat conical in its shape, rises a little above the surrounding surface, and presents the appearance of a flea-bite. By the fifth day, the point has augmented considerably in volume: it is of an umbilical form, with a slight central depression, and its cuticular covering is elevated by a minute quantity of transparent fluid into a firm and resisting pustule. On the sixth day, all these characters are more distinct, and the affected part stands out in bold relief. The vaccine tumor is increased in all its dimensions, and its inflamed surface has a more transparent and polished aspect. The pustule, which until now was quite small, occupies a circle of about a line in diameter; its surface has a radiated, argentine appearance; its edges are smooth and rounded; and its centre is not only more depressed, but it is hard, dry, and of a darkish color. From this time on, the pustule gradually augments in size, the margin becomes more prominent, and the centre exhibits a concave cup-like form.

During the second stage, that is to say, from the ninth to the eleventh day, the pustule attains its most perfect development, being about four lines in diameter, and projecting from one to two lines above the surrounding level. It is encircled by a vivid red areola, often several inches in extent; its margin becomes more full, and the central depression is either partially or wholly effaced. The erythematous surface around is the seat of a great number of minute vesicles, and there is marked swelling of the subjacent cellular tissue, extending generally to the axillary ganglions, and rendering the limb stiff and painful. The virus, which is now ripe for use, is still limpid; and, if the pustule be punctured, it will ooze out, drop by drop, until the little cells containing it are emptied. These cells, as has been ascertained by dissection, are extremely small, as well as numerous, and perfectly distinct from each other, none of them communicating together. Gendrin states that they are



arranged in two concentric rows; and that the centre of each pustule is occupied by a minute quantity of yellow muddy pus, contained in a sort of funnel-shaped receptacle just beneath the cup-like depression of the epidermis.

On the eleventh day, the commencement of the third stage, the desiccating process sets in. The central depression assumes the appearance of a light brownish crust, the contained virus acquires a muddy serous color and a viscid, ropy consistence, the areola gradually fades, the swelling decreases, and the epidermis falls off in small furfuraceous scales. By the fourteenth day, the pustule is greatly diminished in size, the scab is of a horny hardness and of a yellowish complexion, and the areola is reduced to a narrow purple circle not more than the eighth of an inch in diameter. From this period, the swelling and tension of the arm rapidly subside, the vaccine crust augments in density and depth of color, and is detached about the twenty-fifth day, counting from the insertion of the virus. The scar thus disclosed, is slightly depressed, of a circular shape, from three to five lines in diameter, and of a pale reddish hue, exhibiting a number of small honey-combed pits, indicative of the number of cells of the vaccine pustule. The cicatrice becomes ultimately whiter than the surrounding skin, and the pits remain indelible.

The fallen scab is of a brownish mahogany color, hard, dry, brittle, of a circular shape, and more solid, as well as thicker and more opaque, in the centre than at the circumference. Its upper surface is smooth, convex, and somewhat polished; the other, on the contrary, is rough, flattened, or slightly concave. Albumen is its chief ingredient. When recent, it may be cut into thin, grayish slices, which expand by maceration, turn white, and exhale a sickening animal odor. Drying hardens it very much; and trituration with water converts it into a ropy, cream-like mixture, which is capable of communicating the disease. The induration of the scab is much influenced by the atmosphere. If the air is excluded, the secreted matter is thrown off in small, soft pieces, without the formation, frequently, even of a scar.

*Variola* is an acute, cutaneous inflammation, consisting of numerous umbilical pustules, preceded and accompanied by fever. It is contagious, occurring generally only once in the same person, and running its course in about twenty-eight days. When the pustules are situated at some distance from each other, the disease is said to be distinct, and confluent when they are agglomerated. It is also divided into natural and inoculated, according as it arises spontaneously, or from the introduction of the small-pox virus. The period which intervenes between the infection and the development of the disease varies from six to twenty days. The pustules not only cover the skin, but frequently also the mucous surfaces that are directly continuous with it, as the eyes, mouth, and pudendal lips.

The eruption, which is sometimes preceded by a general erythematous blush, usually takes place from forty-eight to eighty hours after the commencement of the indisposition, appearing first on the face and neck, then on the chest, abdomen, arms and legs, and lastly on the hands and feet. This order of invasion, however, is not constant; for it not unfrequently happens that the disease first manifests itself on the trunk, and even on the extremities, before it attacks the head, although it is on the latter region that it is always most violent. The eruption begins in small, red, circular points, having very much the aspect of flea-bites, and which, although widely dispersed originally, rapidly multiply, and, in the course of a few days, complete their number,—the cutaneous surface being in the mean time, hot, tumid, and shining. During the period which intervenes between the efflorescence and the suppuration, embracing nearly one week, the elevations

gradually increase, project above the level of the surrounding parts, and assume the appearance of distinct pustules, each of which exhibits a well-marked central depression. As early as the second day, these elevations are already bounded by a regularly formed ring of inflammation: their form is umbilical, and their summit contains a drop of limpid fluid. In this manner, the development proceeds until suppuration commences, which it usually does about the sixth day. During this period, constituting what is termed the eruptive stage, the pustules have a cellular structure, being composed of little compartments, separated by thin partitions which converge to a central point.

The suppurative process having commenced, the pustules lose their umbilical shape and become hemispherical; their surface acquires a rough, whitish aspect; and their contents continue to grow more and more opaque, being at first of a milky hue, and afterwards of a pale straw color, with various degrees of turbidity. A small circular speck now generally appears in the centre of each elevation, which gradually extends towards the circumference, until at length the whole superficies assumes the same purulent look. Whilst these changes are taking place externally, the internal cellular structure gives way, the little compartments are broken up, and the matter occupies a single cyst, with dense, resisting parietes. With proper care, this cyst can be readily lifted out of its situation: it is of a rounded shape, from two to four lines in diameter, and is deeply lodged in the dermis, projecting a considerable distance into its substance. The suppurative process usually begins on the forehead and face, and ends on the hands and feet, where the pustules also remain much longer before they break, owing, no doubt, to the great thickness of the cuticle. The intervals between the pustules, during this stage, are generally tumid, from the infiltration of sero-albuminous matter, and of a florid red, the inflammation being of a phlegmonous character; and the patient experiences a sensation of tension and soreness, occasionally amounting to real pain.

About the tenth day, the pustules have arrived at their full height; they are filled with thick, yellowish pus, and they present the appearance of so many little abscesses. The desiccating process always begins on the face, and gradually extends to the other regions of the body, occurring last on the feet and hands. It is usually accompanied with violent itching, and with a peculiar nauseous odor, not unlike that exhaled by the rattlesnake. The scabs, which fall off from the tenth to the fifteenth day after the appearance of the eruption, are of a brownish color, lamellated, dry, and of a horny consistence. The scars which are left by their detachment, and which are commonly confined to the cranio-facial region, are depressed at their middle, and traversed by small, narrow ridges, which often greatly disfigure the features, especially in the confluent variety. In regard to their form the utmost irregularity prevails, some of them being circular, some oval, others angular. Their depth is usually considerable, presenting an appearance as if they occupied a goodly portion of the thickness of the dermis. These scars are at first red, but soon change to a dark purple color, which they retain for many weeks; by degrees, however, they grow whiter and whiter, but they always remain more pale and opaque than the rest of the skin.

The skin of variolous subjects putrefies much more promptly than the cutaneous tissue in the sound state. By artificial injection, all the capillaries can be so completely distended as to give the affected part a red scarlet hue; but it is a singular fact, that none of the matter ever finds its way into the pustules, or even into the dermoid substance immediately around them, — owing to the circumstance, as is supposed by Gendrin, that all the vessels in this situation are either obliterated or wholly destroyed, the tissue itself being of a

deep, uniform color, and infiltrated with blackish blood. If mercury be used, a portion of it is generally effused both around and within the pustules; yet none of it appears to enter the vessels of these parts.

Allied to the disease just described, *Varicella*, like small-pox, is contagious, and usually occurs only once in the same individual, attacking children in preference to adults. Preceded by slight fever and other symptoms of derangement, the eruption generally commences on the body, though sometimes on the face and limbs, and gradually rises into small, red, circular points, which, in turn, are replaced by lenticular, globular, or conical pustules, somewhat analogous to those of variola. The pustules are sometimes discrete, sometimes collected together: they are surrounded by a red, rose-colored areola, contain a transparent serous fluid, which in time assumes a thick milky appearance, are soft and flaccid to the touch, and generally terminate, from the fifth to the ninth day, with a thin, brownish, furfuraceous desquamation, which rarely leaves any cicatrice. The eruptive stage of varicella is rarely completed under two or three days, and hence the disease is often prolonged to a fortnight, the parts on which it first broke out being covered with scabs, when the pustules in other regions have scarcely arrived at maturity.

3. *Papular Diseases*. — The lesions arranged in this order are characterized by hard, solid elevations, usually of the color of the skin, to which they impart a rough, uneven sensation, preceded and accompanied by pruritus, and terminating by resolution, desquamation, or slight ulceration. Their progress is commonly slow; and there is no part of the cutaneous surface which is not liable to be attacked by them. The only diseases belonging to this division are lichen and prurigo.

*Lichen* is a non-contagious disease, which may appear on any part of the body, though in most cases it manifests a decided preference for the neck, face, hands, and fore-arms. It is distinguished by hard, firm papulæ, generally of a white color, sometimes red, almost always clustered together, and accompanied with considerable itching, which is augmented by the heat of the bed, and liable to well-marked exacerbations. The elevations are seldom larger than millet-seeds; and, although commonly aggregated into irregular groups, yet occasionally they are united into circular patches, or into long, narrow strips, stretched spirally around the affected part. The accompanying redness, if there be any, disappears about the end of the fourth day, though sometimes not until much later, and is followed by a slight furfuraceous desquamation, which may continue for several weeks, or even months. In violent cases, the papillæ occasionally ulcerate, and discharge a thin, sero-purulent fluid, which gradually concretes into small, soft, yellow scabs, somewhat rough, and easily removable. At other times, again, the elevations become confluent, and are surrounded each by a small, reddish border.

In chronic lichen, the skin is harsh, dry, and sometimes considerably thickened. Deep fissures are also frequently observed, especially about the joints, and the cutaneous functions seem to be almost entirely suspended.

*Prurigo*, in its essential characters, resembles lichen, but differs from it in the greater size of its papulæ, the excessive itching, and the want of discoloration of the skin. It is always chronic, its duration varying from one to many months; and its most usual seats are the neck, shoulders, and pudendal lips, where the desire to relieve the pruritus by scratching is frequently irresistible. Ordinarily, the papulæ are very numerous, especially in young persons, and it is by no means uncommon to observe several successive crops of them, — new ones appearing as fast as the old ones heal. From the intolerable itching



which attends them, they are apt to become torn by the nails, and replaced by small, blackish, circular scabs.

4. *Bullar Diseases*. — The bullar diseases, which are, properly speaking, only two in number, are marked by the formation of small bladders, of a circular figure, varying in size from that of a pea to that of a goose's egg, generally transparent, and filled with a serous, lymph, or sero-purulent fluid, which is poured out between the dermis and cuticle. These small bladders attain their height in the course of seventy-two hours, when they commonly burst, and are succeeded by scabs, sometimes of considerable thickness. Their progress is generally chronic, and their duration varies from one or two weeks to several months.

*Pemphigus* is characterized by the formation of large bullæ, generally of a pale straw color, isolated, and occurring simultaneously on several parts of the body. In regard to its symptoms and duration, pemphigus may be divided into two distinct varieties, the acute and chronic. This division is contrary to the classification of Willan and Bateman, who admit only the latter form of the disease, under the denomination of *pompholix*. The disease is particularly apt to occur in adults and old persons, and is said to be more common in males than in females.

In the *acute variety* of this disease, there are generally well-marked constitutional symptoms, which, in the course of two or three days, are followed by the eruption of small, red, circular spots, which, rapidly increasing in size, soon turn to a more dusky hue. They are then transformed into bullæ, varying from the magnitude of a pea to that of a large hazel-nut, of a rounded shape, and encircled generally by a vividly red border, from one to several lines in width. Their number is variable, from a single one to many: they increase in size during the first twenty-four hours, and the contained fluid, which is at first thin and limpid, becomes yellowish, turbid, and even reddish. They reach their acme by the end of the third day, when they shrivel and dry up; or they burst, and leave small, thin, brownish crusts. The spots exposed by these crusts are of a dull red color, of an irregular form, isolated, and liable, from time to time, to slight exfoliations. The duration of each bulla is about seven days, and not unfrequently there are several successive crops of them on different parts of the body, so that the disease may be protracted for two or three weeks.

*Chronic pemphigus* differs from the acute principally in the greater tardiness of its progress, by the absence generally of the red areola, and in the peculiar mildness of the antecedent and accompanying constitutional manifestations. The bullæ, also, are generally somewhat larger; and, in some rare cases, they cover the whole surface of the body, though they are for the most part confined to particular regions. In three or four days from their first development, they usually break, pouring out a thin yellowish or reddish fluid, so acrid, in some instances, as to irritate the surrounding parts. The sores thus exposed present a red, inflamed aspect; and, as the epidermis dries over them and exfoliates, new bullæ spring up in their neighborhood, and follow the same course. In this way the disease may last for several months or even years. Old people are most liable to it, especially those whose constitution is exhausted by debauch and intemperance.

*Rupia* presents several varieties; but, as has been observed by Cazenave and Schedel, they differ from each other merely in their extent and intensity; and hence, for pathological purposes, it will be proper to consider them under one common head. The affection, which is very analogous to *ecthyma*, usually occurs in a chronic form, its course being seldom run under several

months. It is characterized by small, isolated, flattened bullæ, about the size of a shilling, with or without redness of the skin, and filled with a serous fluid, which soon becomes opaque, puriform, or sanguinolent; and to which succeed thick, rough, dark colored crusts, somewhat thinner at the circumference than at the centre. Ulcerations, either superficial or deep, generally exist under these scabs, which fall off in the course of a few days, and are speedily succeeded by cicatrization. Such, however, is not always the progress of this disease. In some instances the sores remain open for a considerable period, forming scales which are removed as fast they desquamate. Occasionally the disease disappears without the development of scabs.

Rupia sometimes terminates in gangrene. This is particularly apt to take place on the thigh, breast, abdomen, and scrotum of young, cachectic children. The bullæ in such cases are generally preceded by small livid spots, and they often form with great rapidity, their contents being somewhat acrid and of a blackish color. In a short time, the bladders give way, exposing extensive ulcerations, bathed with a bloody, ill-conditioned sanies, and encircled by livid and painful edges. Great constitutional disturbance usually attends this variety of rupia, and not unfrequently it terminates in death. Cicatrization is always slow, and oftentimes the body is disfigured with ugly scars.

*Eczema* is an inflammation of the skin, non-contagious, and liable to occur on the scalp, ears, breast, scrotum, arm-pit, groin and pubes. Though usually limited to one or two spots, it sometimes occupies the whole surface of the body, and may be either acute or chronic. Bielt states that the disease is more frequent in warm than in cold weather, and in women than in men. Arising occasionally without any assignable cause, it is often induced by sudden vicissitudes of temperature, exposure to the hot rays of the sun, dry friction, and the internal or external use of mercury.

Eczema is characterized, at its commencement, by an evolution of very minute vesicles, closely crowded together, transparent, silvery, and reposing upon a surface which is either of the natural color, or else more or less red and inflamed. After having continued for some time, the disease either becomes chronic, or it terminates in the absorption of the fluid, or in superficial ulceration, followed by furfureous desquamation. Much itching and smarting often accompany this disease, and hence it is frequently mistaken for scabies. From this affection, however, it may be easily distinguished by its non-contagiousness, and by the agglomeration and peculiar shining aspect of its vesicles.

In violent cases of eczema, the vesicles become confluent, and are liable to break, giving vent to a thin, sero-purulent fluid, which gradually concretes into soft, yellowish scales, often of considerable size and thickness. These are frequently denuded, leaving always, on being detached, a crimson surface, from which exudes a reddish serosity, which follows the same course until the inflammation subsides, — the scabs becoming every time thinner and lighter, and the sore less red and sensitive. Cases of this kind frequently last for several weeks, some of the vesicles drying as others appear; and they are usually preceded, as well as accompanied, by strongly marked constitutional symptoms.

When the disease runs into the chronic form, the skin being perpetually irritated by the evolution of new vesicles, and the constant discharge of ichorous matter, continues deeply inflamed, at the same time that it is very apt to become chafed and excoriated, especially about the joints. The eruption, in such cases, sometimes persists for months, the secretion, in the meanwhile, going on in full vigor; at other times, however, the discharge is either very

slight, or the part is entirely dry, and covered with thin, soft, yellowish scabs, which, on falling off, expose a cracked and slightly inflamed surface.

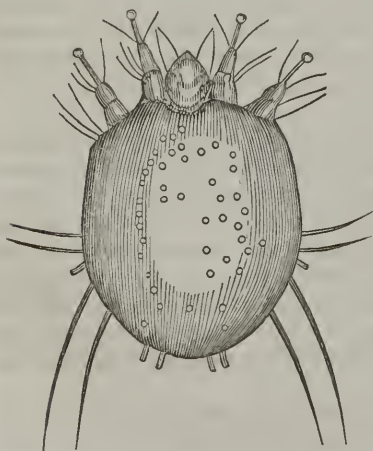
*Miliaria* is an eruptive disease, generally, though not always, symptomatic of other affections, attended with profuse perspiration, and a feeling of heat and itching. Every portion of the body is liable to it, but the regions most frequently affected are the neck, breast, back, and the inside of the thighs. Its duration is from one to three days. The vesicles, which are at first very small and transparent, are rarely confluent; but they often occur in irregular groups or patches, the surface over which they are scattered being either reddened, or of the natural color. When fully developed, as they generally are in the course of thirty-six or forty-eight hours, they are of a rounded form, pearly in their appearance, filled with a milky fluid, and about the size of millet-seeds. The eruption sometimes covers the greater part of the body, but usually it is widely scattered, and confined to particular regions. From eczema this disease may be distinguished by the rapidity of its progress, the shortness of its duration, and by the larger size and greater distinctness of its vesicles.

5. *Vesicular Diseases*.—This class of cutaneous diseases is characterized by the evolution of small vesicles, acuminate or globular, distinct or confluent, and occurring generally in irregularly circumscribed spots, the surface on which they appear being either of the natural color, or marked by inflammatory redness. The contents of the vesicles are at first thin and transparent, afterwards milky and opaque, or even slightly purulent. The eruptions arranged under this group may occur in any part of the body, are seldom serious, and may terminate either by resolution, desquamation, superficial excoriation, or the formation of soft yellowish scabs. Their duration varies from a few days to several weeks, or even months.

*Scabies* is an inflammatory affection, contagious, accompanied by an insect, and characterized by pointed vesicles, transparent at the summit, of a light rosy tint, and filled with a thin, viscid fluid. By scratching, these vesicles are easily broken, when their contents escape, and expose a corresponding number of small, red, inflamed specks, which frequently run into each other. The eruption is sometimes very trifling, but in many cases it is very extensive, covering a large portion of the cutaneous surface. It never, however, appears on the face; and is always most abundant at the flexures of the joints and between the fingers, owing, doubtless, to the great delicacy of the skin in these situations. In infants, the disease is usually developed in four or five days after exposure to the contagion; in adults, in from one to two weeks. A slight itching is first felt in the parts, which is invariably increased by the warmth of the bed, by sitting near the fire, or by stimulating food and drink, and in plethoric habits, is sometimes almost intolerable. No fever attends this affection.

It has been already stated that this disease is accompanied by an insect. Whether this is a constant occurrence is not fully determined, but that it is

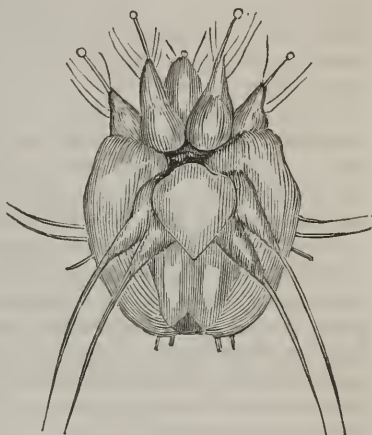
Fig. 99.





occasionally observed is established beyond contradiction by the recent researches of Dr. Renucci, of Paris. The insect, the existence of which was long ago suspected, if not actually demonstrated, by some of the older physicians, is called the *acarus*, or *itch-ciron*, and is seldom to be found in the vesicle, but almost always in a small epidermic canal, which leads from it, and which is either straight or tortuous, and several lines in length. The *acarus* (Figs. 99 and 100) is of a white, opaque color, and about the size of the sharp extremity of the finest needle, presenting, when seen through the microscope, the form of a tortoise. It has eight small feet, and the head is a perfect retracting sucker; the belly presents several dark colored spots, and on the back are to be seen a number of eccentric lines, placed at short intervals, and having the appearance of joints.

Fig. 100.



*Herpes* has been subdivided by Willan and Bateman into six species, — a circumstance which, considering that they all occur pretty much under the same states of the constitution, and require the same kind of treatment, may be considered as a sort of “hair-splitting,” as unnecessary in pathology as it is injurious in practice. The disease is characterized by distinct but irregular clusters of vesicles, which are set in close proximity, upon a vividly red base, surrounded by intervals of sound skin. The spots thus formed vary in size from that of a guinea to that of the palm of the hand, and the vesicles from the smallest pin-head to that of a pea. The lymph of the vesicles, which is at first clear and colorless, becomes gradually milky and opaque, and ultimately concretes into thin brownish scabs, which fall off about the tenth day from the time of their eruption. Sometimes tedious ulcerations ensue, leaving strongly marked cicatrices; and now and then the disease disappears by desquamation, the fluid being absorbed by the end of the first week. In the zonoid variety, vulgarly called “shingles,” the vesicles are aggregated into irregular oblique patches, in the form of a half belt. According to Cazenave, the patches generally begin at the centre of the body, from whence they extend in an opposite direction, without ever passing the median line. Ring-worm is another variety of herpes, the characters of which are so distinct as to render any particular account of it unnecessary.

Herpes lasts from one to several weeks, passing through a regular course of increase, maturation, and decline. It is generally very mild in its character, may be seated on any part of the body, and often coexists with other affections, either cutaneous or internal.

6. *Tubercular Diseases.* — The diseases arranged under this head are characterized by the development of small, solid, circumscribed tubercles, of a rounded or conical shape, of a reddish or purple color, generally isolated, and confined to particular regions. After having continued for some time, varying from a few months to several years, they either disappear, or terminate in ill-conditioned ulcers. The affections which properly belong to this division of the subject, and which are seldom seen except in tropical countries, are Greek elephantiasis, frambæsia, and lupus.

*Greek elephantiasis* is a chronic affection, characterized by soft, prominent

tubercles, which are irregular in their shape, and of a red, livid color. In their size they vary between a pea and a walnut: they are either painful or indolent; and, as they grow older, they gradually assume a dirty bronze complexion, at the same time that they acquire a greater degree of hardness and density. When ulceration sets in, they become the seat of ill-conditioned sores, discharging a thin, sanious fluid, which concretes into thick, adherent, blackish crusts. The most common seat of the disease is the face, the ear, nose, shoulder, buttock, and leg, which are often hideously distorted, both from the immense number of tumors, from the furrowed state of the skin, and from the great swelling of the subjacent cellular substance. Does elephantiasis consist in a hypertrophied state of the cutaneous papillæ? This is highly probable; nevertheless, the question has not yet been determined by dissection. The disease is generally complicated with other affections, and is almost always incurable: Alibert asserts that it is occasionally hereditary. It occurs indiscriminately in adults of both sexes.

*Frambæsia*, vulgarly called *yaws*, is a chronic tubercular disease, indigenous in Africa, and extremely common in America and the West Indies. Although contagious, it can only be communicated by immediate contact, and is infinitely more frequent amongst blacks than whites. The period which elapses between the reception of the virus and the commencement of the eruption is not accurately determined, but does not probably exceed several weeks. The disease affects the same person only once during life, and children are more obnoxious to it than adults.

The eruption, which is generally preceded by slight constitutional symptoms, and which appears successively on different regions of the body, is characterized by minute flea-bite looking pimples, succeeded by irregular, prominent tubercles, which often present the shape, color, and size of a raspberry,—a circumstance from which the disease has obtained its name. The vegetations thus formed are usually distinct at their summit, but almost always united at the base: they are firm, indolent, and covered with thin, dry, and adherent scales. Finally, after remaining stationary for weeks, months, or even years, they inflame, become soft and spongy, and give rise to deep, foul ulcers, from which there is a constant discharge of a yellowish, acrid, and offensive fluid, which soon concretes into thick scabs. Their most common seat is the head; they also occur, though less frequently, in the axilla and groin, around the anus, on the scrotum, and on the pudendal lips. They likewise appear on the shoulders, buttocks, and limbs; but the scalp, forehead, and temples, scabbed and hideously disfigured, are the parts, of all others, which most frequently suffer.

The last affection to be noticed under this head is *lupus*. This is a truly malignant disease, seated for the most part, on the nose, cheek, and chin, and which, if allowed to progress, successively destroys the cutaneous and cellular tissues, and finally the cartilages and bones. It usually commences in a small red point, which is hard and prominent, and appears to affect only the more superficial layers of the skin. The progress of the tubercle is slow and gradual, a long time often elapsing before it attains its full development. By and by, however, ulceration and scabbing commence: the sore is bathed with sanious matter, its edges are raised and indurated, and its bottom exhibits a foul, livid aspect. The tendency of the disease is to spread, both in depth and diameter; hence it frequently invades a large extent of surface, and produces the most frightful ravages. The ulcer sometimes heals spontaneously; the part of the skin over which the disease has passed remaining hard and red, like the cicatrice of a superficial burn.

The number of tubercles varies. Most generally there is only one,<sup>1</sup> but there may be so many as almost to cover the whole face. During the ulcerative stage, considerable pain attends, the skin becomes hypertrophied, and the cellular tissue is distended with sero-albuminous matter. The disease is equally frequent in both sexes, and is rarely met with after the fortieth year. Persons of a scrofulous diathesis are particularly subject to it.

7. *Scaly Diseases*.—The scaly diseases, located in the outer surface of the corion, are characterized by the development of red spots, elevations, or blotches, over which the scarf-skin, dry, opaque, and thickened, incessantly exfoliates and reappears, the process of renovation and decay sometimes going on for years. Easily distinguishable from the crusts which attend vesicular affections, they generally proceed in a slow and insidious manner, unaccompanied with much local or constitutional disturbance; and, although they are rarely dangerous, they are always very disagreeable, as they have a tendency, especially if protracted, not only to disfigure the skin, but seriously impede the movements of the joints. Four genera of lesions have been described under this order by Willan, Bateman, and others; namely, lepra, pityriasis, ichthyosis, and psoriasis. To these may be added a fifth, namely, pellagra.

*Lepra* most commonly attacks the arms and legs, especially the superficial parts below the elbows and knees; it sometimes occurs on the hairy scalp, but seldom exclusively. Commencing in small, red, shining points, scarcely elevated above the level of the skin, it soon forms pretty large patches, often an inch and a half in diameter, of an orbicular shape, disjointed or confluent, slightly depressed in the centre, and surrounded by a florid, prominent circle, from one to several lines in width. The epidermic scales are at first thin, smooth, polished, and transparent; but, in the course of a few days, they are replaced by others, which are lamelliform, hard, tough, opalescent, pearly, or of a pale straw color. These scales fall off, and are incessantly renewed, the surface beneath them being somewhat rosy and inflamed, smooth in recent, and occasionally deeply chapped in old cases.

This disease sometimes gets well spontaneously, the skin from which the scales are detached acquiring at first a peculiar greyish color, which sometimes persists for a considerable period afterwards. In the majority of cases, however, it slowly pursues its career, producing more or less thickening of the skin, and impairment of the locomotive powers. When leprosy is generally diffused, Bateman\* states that there is often considerable cutaneous inflammation, accompanied with extreme soreness, pain, and stiffness, amounting to such a degree sometimes as to render the motions of the joints impracticable, and confining the patient to his bed. According to the same authority, the nails of the toes and fingers are frequently much thickened, opaque, of a dirty yellowish color, incurvated at the extremities, and very irregular on the surface; yet, notwithstanding this there is rarely much constitutional disturbance.

*Pityriasis* is a superficial inflammation of the corion, chronic, non-contagious, and attended with an exfoliation of the epidermis, in the form of very thin, irregular, whitish scales, which are reproduced in great numbers and with astonishing rapidity. Considerable pruritus often attends this affection, leading to an irresistible desire to scratch. Sometimes the cuticle comes away in a mealy, furfuraceous, or pulverulent desquamation; and, in the generality of cases, the corion is singularly discolored, sometimes of a copper tint, brownish, or almost black. The scales, whatever may be their size and form,

\* Practical Synopsis of Cutaneous Diseases, p. 26. Second edit. Phila. 1824.



are always dry, easily detached, and spread over a large surface, the affected part being often many inches in diameter, and interspersed with portions of sound skin. The most common seats of pityriasis are the scalp, eyebrows, breast, and epigastric region, together with the arms and shoulders.

*Ichthyosis* is a chronic cutaneous affection, appearing in large continuous patches, which occasionally cover the greater part of the body. It is characterized by the formation of thick, rough scales, of a greyish-white color, and almost horny texture, without pain, heat or pruritus, and without the deciduous exfoliations which belong to lepra and psoriasis. The whole skin seems to be deeply involved in this affection; and hence, in the advanced stages, it is generally in an extremely dry, stiff, and uncomfortable condition, at the same time that it is greatly hypertrophied and almost of gristly hardness, the different layers of which it is composed being no longer distinguishable from each other. In regard to their form, the epidermic scales present almost innumerable peculiarities. Sometimes they are of uniform thickness, and seem to be merely elevations of the common lozenges of the cuticle; sometimes they are flat, thin, and imbricated; sometimes they have short rounded necks, with broad irregular tops; and occasionally, again, though very rarely, they sprout out in the form of excrescences, of a horny texture, and most grotesque appearance. The quantity of these morbid excretions is, in some instances, immense, the whole body being literally encased with them like a shell. In old, inveterate cases, a considerable amount of calcareous matter is frequently poured out, both upon the surface of the scales, and in the intervals between them.

The color of the scales varies not only in different subjects, but frequently in different parts of the same individual. As was before stated, most of them are of a greyish-white; but, in many instances, they are brownish, greenish, or blackish. They have also been known to exhibit a shining, pearly aspect, and to be surrounded by a blackish looking border.

During the warm weather of summer, this disease sometimes nearly disappears, the scales dropping off in large quantities, especially at night. It is usually aggravated by arid states of the atmosphere, and is always most troublesome during the severe cold of winter. Unpleasant sores sometimes attend ichthyosis, more or less painful, prurient, and discharging a thin, acrid humor: the general health is usually much impaired, and, occasionally, the whole body emits a peculiar, fishy exhalation.\* Sometimes the patient is harassed with pustular eruptions.

Ichthyosis generally begins very early in life; and, in a number of instances, it has been known to be hereditary. This fact is strikingly illustrated by the curious and instructive cases published, several years ago, by Professor Francis, of New York.† The most usual seats of the disease are the outer regions of the extremities, both upper and lower, the sides of the trunk, and the shoulders. The flexures of the joints and the inner surface of the thighs are seldom affected.

*Psoriasis*, vulgarly called the *scaly tetter*, consists of solid, inflammatory elevations of the skin, forming various-sized patches, isolated or united, covered with thin, white, shining scabs, and commonly accompanied by slight constitutional symptoms. The eruption sometimes affects a peculiarly tortuous, serpentine shape: in other instances, especially when it breaks out on the lips, it pursues a circular direction, ring after ring forming regularly beyond the surface last attacked. The corion is generally somewhat rosaceous, and, in bad

\* See Sauvage's *Nosologia Method.*

† *American Journal of the Medical Sciences*, August, 1828.

cases, considerably thickened and chapped: a very disagreeable itching, attended occasionally with a good deal of pain, is pretty constantly present; and the scales, seldom very adherent, are frequently detached and reproduced. Sometimes the eruption is entirely confined to the limbs; at other times it covers the whole body; and, in such cases, the patient appears, in the language of Cazenave and Schedel\* to be literally enclosed in a squamous envelope. Occasionally, the nails split, become yellow, and at length fall off; and the least movement frequently produces rents in the skin, followed by a flow of blood. Occurring at all ages, it is liable to disappear, and recur at certain seasons; in some individuals it never entirely ceases.

The fifth and last disease we have proposed to notice under the present head is *pellagra*. This is very common in certain districts of Italy, where it sometimes prevails epidemically, especially during spring and summer, but is entirely unknown in this country. Adults alone suffer, and both sexes are equally liable to it. Its course, which is always chronic, lasts from one to several years, the complaint becoming annually more and more aggravated, until the unfortunate patient, harassed and disfigured, finally sinks beneath its blighting influence. Dissection always discloses extensive lesion of the internal organs, particularly of the alimentary canal.

More or less constitutional derangement usually precedes this affection, which manifests itself by small, red, shining spots, accompanied with slight tumefaction of the skin, together with a sense of fulness and tension. By degrees, the color of these spots becomes deeper; their surface is covered with thin scales; and, as they augment in size, they unite, and form large, irregular-shaped patches. The skin, meanwhile, is not only considerably thickened, but disfigured with deep rents and fissures. After remaining in this state for some time, the scales gradually drop off, disclosing a red, glossy surface, from which there is a constant bran-like exfoliation of the epidermis. The neck and limbs are the parts most usually affected.

8. *Syphilitic Diseases*.—The last group of diseases that we shall notice is the syphilitic. The disorders comprehended under this appellation are caused by the influence of the venereal virus and manifest themselves under at least six varieties of form, the exanthematous, vesicular, pustular, tubercular, papular, and scaly. They are occasionally *primary*; that is to say, they appear simultaneously with the affection of the genital organs; but, in the great majority of cases, they are not developed until some time subsequently,—generally not under a few months; and they are therefore said to be *consecutive*. The eruptions appertaining to this group usually pursue a chronic course, are circular in their form, and present a characteristic copper color: though occurring on all parts of the body, they are principally observed on the forehead, nose, cheek, back, and shoulder, and are attended with thin, greyish scales, or with hard, thick, greenish scabs.

In the *exanthematous* form, the spots are of a circular shape, and about the size of a quarter of a dollar: they are almost always situated on the trunk and extremities, are of a dark copper color, do not disappear under pressure, are never confluent, and generally terminate by a slight exfoliation of the epidermis. Cazenave and Schedel describe a variety of this eruption, which is characterized by small, irregular, greyish spots, of a deeper red than the preceding, more transient, slightly confluent, and disappearing, though slowly, under the pressure of the finger.

The *vesicular* form is extremely rare. Rayet gives only a solitary example

\* Cazenave and Schedel, *Practical Synopsis*, p. 253.

of it; Cazenave and Schedel also saw it but once; and Bielt never met with it, except on three or four occasions. It begins in minute, circumscribed pimples, scattered over different parts of the body, to which succeed small vesicles, filled with a transparent fluid, and surrounded by a red, copper-colored areola: their progress is very slow, and their contents are either absorbed, or they congregate into thin scales, which, falling off at different intervals, leave the surface of a dingy, yellowish hue. The vesicles are sometimes extremely numerous, and cover nearly the whole body.

The third form of syphilitic disease is the *pustular*. This variety, as the name indicates, is characterized by the presence of small tumors, containing an ichorous, serous, or purulent fluid. Their size and shape are subject to considerable diversity. Occasionally, they are as big as a hazelnut; but, under ordinary circumstances, they do not exceed the volume of a common pea, and, indeed, are seldom so large. In their shape, they are sometimes conical, sometimes oval, sometimes pediculated, sometimes rounded, and sometimes flattened, with a minute, central depression. Now and then, all these varieties are observable in the same individual. Their number is often immense, hundreds being scattered over a small extent of surface; and, as they form successively, they may be seen and studied in every stage of their development. Each pustule reposes upon a hard, copper-colored base: its internal structure is not known: it appears to be not unlike that of small-pox.

After remaining for a short period, the contents of the pustules escape, congregate, and form hard, thick scabs, of a dark color, pretty firmly adherent, and sometimes circularly furrowed. In mild cases, the scabs soon fall off, and leave merely a chronic induration, a livid or greyish stain, or a slight cicatrice: in severe ones, on the contrary, deep, circular ulcers are exposed, with a foul, greyish bottom, and a hard, purple, and regularly-defined margin. In cases of the latter description, the scabs are frequently renewed, and are finally replaced by round, indelible scars.

In the *tubercular* form — the most frequent, perhaps, of all — the eruption consists of small, red, copper-colored eminences, varying in size between that of a mustard-seed and an olive. Of a rounded, flattened, or conoidal shape, they are either isolated, assembled in groups, or arranged into perfect circles: they are smooth and polished, produce little or no pain, and become covered, in a short time, with a dry, scaly incrustation, which is generally reproduced as fast as it falls off.

In the more aggravated forms of this variety of syphilis, the tubercles are inordinately large, prominent, of a deep violet hue, from three to nine lines in length, and encircled by a well-marked, copper-colored areola. After continuing thus for some time, varying from a few months to several years, they become painful, inflame, suppurate, and are replaced by deep, foul, irregular ulcers, reposing upon a hard, purple base. A thick scab usually covers these erosions, which is repeatedly renewed, disclosing, each time that it is detached, that the sore is extending its ravages. When the tubercles are numerous, the ulcers, running together, often acquire a frightful size, and, on healing, leave disfiguring cicatrices.

*Papular* syphilis is characterized by the occurrence of small, hard, solid elevations, containing no fluid, and terminating almost always in desquamation, seldom in ulceration, or in the formation of scabs. Of the two varieties of this affection described by authors, one is acute and primary, the other chronic and secondary.

In the first variety, which, according to Carmichael and others, sometimes accompanies gonorrhœa, the eruption appears simultaneously on different re-



gions of the body, and is completed in about forty-eight hours from the time of its first invasion. The papulæ are extremely small, disjoined or grouped, of a red copper color, and of a slightly conical shape, being surrounded, here and there, by violet areolæ, which are often confluent, and give the surface a characteristic yellow tinge. Ulceration rarely attacks these papulæ: they disappear in a short time, and are followed by a furfureous desquamation of the cuticle.

In the other variety, the eruption is developed in a slow and successive manner, being announced by small yellow spots, which are particularly numerous on the forehead, scalp, and extremities. The papulæ, which are of a light, copper color, are larger than the preceding, flat, of the size of small beans, grouped, and devoid of an areola. In time, the summit of each elevation becomes covered with a dry, greyish pellicle, which is regenerated as fast as it desquamates, until the disease finally entirely subsides. Meanwhile, the skin between the agglomerated papulæ undergoes important changes: it assumes a dingy, yellowish color, has a dry, shrivelled aspect, and is the seat of a constant exfoliation of the cuticle.

The sixth and last form of syphilitic disease is the *scaly*, which manifests itself, as the name imports, by dry, greyish imbrications, situated on small, copper-colored elevations. This variety, which is always consecutive, persists for a long time, and terminates by desquamation. The eruption, in the plurality of cases, appears in patches, which, although they may occur on all parts of the cutaneous surface, are most common on the forehead, scalp, and face. They are from four to eight lines in diameter, in shape irregularly rounded, ordinarily isolated, smooth, polished, and somewhat elevated; each is covered with a thin, hard, whitish scale, which is very slightly adherent, and which, on falling off, exposes a small, shining, copper-colored eminence.

9. *Stains*.—There are certain discolorations of the skin, which, from the frequency of their occurrence, rather than from any pathological interest, require to be mentioned in this place. Of these, the principal are *ephelis*, *lentigo*, *albinism*, and *nigritism*. They are seated in the vascular network of the skin, and no doubt depend upon some alteration of the coloring matter: some of these stains are congenital, and it is a singular fact that they seldom affect the whole cutaneous surface. Their duration varies from several weeks to many years.

*Lentigo*, generally known by the name of *freckles*, is characterized by yellowish, fawn-colored spots, varying in size, from a pin-head to that of a five cent piece: they are most common on the face, neck, chest, and hands, in persons with light eyes and red hair; are often congenital, and last through life. When the spots are very numerous, they sometimes run into each other, and thus form large, irregular-shaped patches.

In *ephelis*, the stains are of a yellow saffron color, very irregular in shape, and much larger than in *lentigo*. Their most common situation is the neck, the anterior part of the trunk, and the inside of the thigh: they are never observed on the face, except during pregnancy, on which they are a frequent attendant. The spots, which are often preceded and accompanied by considerable itching, are at first of a greyish color, small, isolated, and rounded: by degrees they assume a yellow tint, augment in size, and unite into large, irregular patches: their duration varies from a few days to several months, and their disappearance is frequently followed by slight exfoliation of the epidermis.

The skin is sometimes converted into a dead, milky-white color, constituting what is termed *albinism*. This change, which is confined to no particular

race, depends not upon the absence of the pigment, but rather, I apprehend, upon some modification of its component elements. Persons who present this peculiarity differ, in many respects, from ordinary individuals. Their whole organization, both mental and physical, seems to be imperfect; the body is covered with a soft, silky down; the hair is often of a snow-white color; the eyes are feeble, and unable to bear the light; and the iris and choroid are of a light rosy tint, from the absence of black pigment.

There is a variety of albinism, which is limited to particular regions of the body, usually the head and trunk, to which the term *vitiligo* has been applied. It commences in small, milk-white spots, which go on enlarging until they sometimes cover the whole surface. The spots are generally oval or rounded, and now and then they have an irregularly striated arrangement. When the disease occurs on the scalp, axilla, and pubes, the hair participates in it, and becomes deprived of its natural color. Negroes who exhibit this peculiarity are called piebald.

*Nigritism* is the term employed to designate the reverse of the condition just described. The affection is generally local, appearing in small, irregular-shaped patches, from one to several inches in diameter; the parts of the body most subject to it are the genital organs of the male, and the nipple of the female. The face is also sometimes the seat of it. Of this, the singular case recorded by Lecat\* affords a striking illustration. The patient was a lady, about thirty years of age. The discoloration was first observed in the seventh month of her pregnancy, commencing on the forehead in a greyish, dusky-looking spot, and extending by degrees over the whole face, except the eyes and the margins of the lips, which retained their natural complexion. The altered skin was very tender to the touch, but in other respects the lady suffered no inconvenience. The black color disappeared two days after delivery, with a profuse perspiration, by which the sheets were stained black. The same phenomenon was witnessed during several succeeding pregnancies. Cases of an analogous kind have been reported by Chomel, Goodwin, Rostan, Rayer, and other writers. The affection has hitherto been observed principally in females.

It is well known that the nitrate of silver, if administered for a long time, has the effect of imparting a grey slate color not only to the skin, but also to accidental cicatrices, the conjunctiva, and to the mucous membrane of the alimentary tube. The discoloration generally remains during life, and is always most conspicuous on the surfaces exposed to the light and air, as the face, neck, and hand. How this change is produced, the present state of our knowledge does not enable us to explain. The most plausible conjecture is, that the coloring matter of the skin has a special affinity for the substance in question, by which they combine with each other, at the same time that they undergo some alteration in their properties. What gives countenance to this idea is, that the color remains after boiling, and that no impression can be made upon it by medicine. Mr. Brande asserts that he has detected oxide of silver in the stained organs. It should be added, that the discoloration produced by this substance is occasionally of a dirty bronze appearance.

\* *Traité de la Peau Humaine*, p. 136. Amsterdam, 1765.

## SECTION II.

## OF THE NAILS.

The *nails*, situated on the dorsal surface of the fingers and toes, with which they correspond in number, are formed of a homogeneous substance, of the same nature as horn. Their chemical properties are those of coagulated albumen, with the addition of a minute quantity of phosphate of lime, to which they are chiefly indebted for their hardness. In the sound state, the nails are semi-transparent, flexible, and elastic: each has a root, a body, and a free extremity.

The root forms about the sixth part of the entire nail: it is very thin and soft, of a white color, and is inserted into a groove of the dermis, at the same time that it is covered by a reflection of the cuticle. The body, intermediate between the root and free extremity, is of considerable thickness, and constitutes by far the greater portion of the organ. Of its two surfaces, the external is longitudinally grooved, and transversely convex; the other is concave, also furrowed, and closely adherent to the true skin. The free extremity is the thickest and strongest part of the nail: it projects a short distance beyond the end of the finger, and is usually somewhat incurvated.

The most interesting structure about the nails is the apparatus determining their growth and direction. This is a peculiar papillary substance, from a quarter to a third of an inch in length, situated at their posterior extremity; it presents a linear, striated surface, is extremely sensitive, and of a florid color, from the immense number of its capillaries. When this apparatus is destroyed, no further growth takes place. The nails themselves have neither vessels nor nerves; none at least have ever been traced into them.

When a nail is torn away, it is gradually regenerated, — the period required for this purpose varying from three to six months, according to its size, and the violence inflicted upon the secreting apparatus. Eight or ten years ago, I received a severe contusion on my left thumb, the consequence of which was an exfoliation of the corresponding nail. As the old nail became detached, a new one gradually formed, and, in six months from the time of the injury, had acquired its full size and development.

*Inordinate length* of the nails is of very common occurrence, and would be still more so, were it not for the constant paring to which they are subjected. Left to themselves, they sometimes grow to the distance of three, four, or five inches, pursuing a tortuous, spiral course, so that they occasionally bear a much closer resemblance to claws than nails. (Fig. 101.) Their thickness, under such circumstances, is generally considerably augmented, from the superaddition of lamellæ, which often overlap each other, like the scales of a fish. The extension and thickening of the nails form a prominent feature in ichthyosis, leprosy, and elephantiasis. The nails, in these diseases, after having acquired a certain length, sometimes fall off, and are reproduced, though seldom perfectly. They are even said to become painful, so that they can be no longer cut, which, however, is doubtful.

Fig. 101.





In Polish plait, the nails both of the fingers and toes, often acquire a great size, and a yellowish, livid, or black complexion.

The nails are sometimes absent, as a congenital defect. More frequently, they are unusually small, or developed imperfectly, their place being supplied by thick, horny cuticle. On herpetic persons, I have repeatedly found them very short, scaly, and of a thick, rounded, button-like form. In strumous subjects, they are sometimes deeply grooved, enlarged, and of an indurated, horny consistence. In protracted paralysis, the nails grow very slowly and imperfectly, probably from a deficiency of nervous energy.

A *vicious situation* is occasionally observed. Thomas Bartholin\* has recorded an instance where the nails occupied the anterior extremity of the metacarpus, the fingers being absent. In other cases they occupy the lateral surfaces of the fingers; and occasionally, though very rarely, they have been re-produced on the second or first joint, after the partial or complete loss of the part on which they are naturally situated.

In monsters, the nails of the fingers are sometimes consolidated. The same deformity has been observed in adults. Otto saw a case in which the four outer nails of both hands were united into one. In pulmonary phthisis, the nails are almost always incurvated; a fact which did not escape the observation of Hippocrates, and which has been noticed by every practitioner of medicine since his time.

The nails, as we have already seen, are the product of a soft, pulpy, vascular apparatus, which is situated at their roots, and may, from its office, be denominated the *ungueal matrix*. This structure is subject to various degrees of inflammation, attended with corresponding alteration of the organs under consideration. The causes of this disease, which I shall name *onyxitis*, are sometimes of a local, but more frequently of a constitutional character. Amongst the latter, is a serofulous, gouty, or syphilitic taint, which often exerts its influence for a very long time, and baffles our best directed efforts for its removal.

Onyxitis commences in a circumscribed swelling of the ungueal matrix, with pain and deep redness. In a short time, a thin, ichorous fluid issues from the cleft at the root of the nail, and at last the soft parts give way. The ulcer is very small at first, but gradually extends, until it finally involves the whole of the ungueal matrix, together with a portion of the dermis immediately around it. The surface is brown and glossy, the margin thin and sharp, the discharge fetid and irritating. The pain is sometimes intense; at other times the disease is more indolent, and accompanied with little uneasiness. The nail is formed very imperfectly; it loses its natural form and color, becomes irregular, dry, black, and at length falls off. When this happens, it is seldom completely regenerated. The surrounding skin is tense and livid, the affected extremity assumes a bulbous appearance, exceeding often double the normal size, and, in cases of long standing, the disease sometimes invades the subjacent bone. Onyxitis occurs chiefly in young persons, and attacks the thumb more frequently than the fingers or toes. It may continue for years.†

\* Hist. Anat., t. i., 291.

† For an excellent account of this disease, the reader may consult the paper of Mr. Wardrop, of Edinburgh, published in the fifth volume of the London Medico-Chirurgical Transactions. He has described it under the name of *onychchia maligna*, from the obstinacy and malignity of its character.

## SECTION III.

## OF THE HAIRS.

Although the hairs bear a general resemblance to the nails, yet they differ from them in several essential particulars. Like the organs just mentioned, they are of a horny consistence, but their color is darker, and their chemical composition more complex. Besides an albuminous matter, which forms the basis of both, Vauquelin detected in the former a small quantity of oil, phosphate and carbonate of lime, oxide of manganese, iron, silice, and sulphur.

With the exception of the palm of the hand and the sole of the foot, hairs are found upon almost every part of the body. In some regions they are coarser than in others, and hence the distinction of them into two kinds, the crinal and pilar. The former grow on the scalp, the latter on the eyebrow, the margin of the eyelid, and on the body. Not only are the crinal hairs finer than the pilar, but they differ from them still farther in regard to the time of their full development, their color, and their length.

A hair consists of a follicle and stem. The follicle is a sort of an ovoidal cup, occupying the substance of the dermis, which it traverses obliquely. Being perforated at both extremities, at one for the exit of the stem, and at the other for the entrance of vessels and nerves, it is composed of two tunics, closely united together, but widely different in structure. The outer membrane is white, firm, and intimately adherent to the dermis; the inner, on the contrary, is reddish, extremely soft, and apparently continuous with the rete mucosum. Within this delicate lamella is the proper secreting organ of the hair, which is of a conical form, highly vascular and sensitive, and bears a very near resemblance to the pulp of a tooth.

The stem varies in length, as well as in thickness, in different regions of the body. It is of a conical shape, and of a dark color. One extremity is free, hard, and sometimes bifid; the other is soft, white, and hollowed out, so as to embrace the central pulp on which it grows, the part which is first secreted being forced on by that which exudes last. The intermediate portion is a diaphanous, horny sheath, containing a dark, spongy, filamentous substance. It is either straight, twisted, or curled.

The piliferous follicle, as before stated, is implanted in the substance of the dermis, by which it is protected and kept in place. To secure it still further, the cuticle enters the external opening of the follicle, from whence, after having lined its margin, it is reflected upon the surface of the stem, upon which it is soon lost.

With regard to the vitality of the piliferous follicle, there is no doubt; but, in respect to that of the stem, it is a matter of inference rather than of observation. It is uncertain whether the vessels of the secreting pulp are or are not, in the natural state, continued into the stem, so as to extend into its substance beyond the level of the cutaneous surface. In endeavoring to decide this question, reliance is to be placed mainly upon analogy and upon what occurs in disease. In phrenitis, the hair has been so sensible after an injury, that the slightest touch gave severe pain; and, on clipping a stem, unseen by the patient, this was instantly felt, and occasioned a paroxysm of rage.\* In the Polish plait—a disease which will be more particularly described in another paragraph—the hair, it is said, sometimes bleeds; and, if this is true,

\* Elliotson's *Human Physiology*, p. 277. Fifth edition. London, 1835.

it is surely more consonant with the principles of sound physiology to suppose that the blood proceeds from pre-existing vessels than from vessels of new formation.

If we appeal to analogy, we shall find that the hoof of the horse and other animals, although apparently unorganized, is abundantly supplied with vessels, not less so than the quills and feathers of birds. If the pulps of the quills of the porcupine be well injected, vascular lines may be traced into that structure to almost any distance, and the same may be seen, even without the aid of a magnifying-glass, in the growing feathers of our domestic fowls. The horn of the ox, when broken or sawed off, will occasionally cicatrize. Of this, a beautiful specimen is contained in my museum of morbid anatomy. It is about three inches long, and had evidently been broken when the animal was only a few years old. If we connect these facts with the circumstance, perfectly attested by many highly respectable authorities, of the hair losing its color in the course of twenty-four hours, the probability is strong that the structure under consideration is organized, though less perfectly, perhaps, than almost any other in the body. In the African lion, I have succeeded in tracing filaments of the fifth pair of nerves into the bulb of the whisker; and the same thing has been done by Rudolphi in regard to the mustachios of the seal.

Most of the lesions of the hairs are directly referable to inflammation of their follicles. In the plurality of cases, the inflammation pursues a chronic course; but what particular changes the structures in question undergo, is by no means ascertained. It is altogether probable that the piliferous follicles are considerably swollen and injected, and that their power of secretion is either suspended, or at all events very greatly modified; so that the stem, instead of presenting its normal characters, is variously altered, both in its consistence, its length, its thickness, and, above all, in its color.

The *Polish plait*, as it is termed, a disease which is endemial in Poland, Lithuania, and Tartary, seems to be an inflammatory affection. It generally attacks an immense number of piliferous follicles, which in a short time acquire an extraordinary size: they rise above the level of the skin, are painful on the slightest touch, and exude a large quantity of viscid, brownish, and offensive matter, by which the hairs are matted and glued into inextricable tangles, of great length. Even the stems are said to be swollen and increased in thickness; their cavity is also larger than in the sound state, and their areolar texture is rendered unusually distinct. Dr. Schlegel, a German author, assures us that, in a case of the Polish plait, he found all the hairs of the body not only tumefied, but distended with yellowish-brown fluid, and at least six times as large as in the normal state. This disease generally appears during the autumnal months, is observed chiefly in the lower classes, and is often extremely obstinate and persisting. Although the hairs of the head generally alone suffer, yet those of the beard, axilla, and pubes, are sometimes similarly affected. It has been already intimated, that the hairs occasionally bleed in this disorder. This, however, is still a litigated point, and one which can only be decided by further observation. The late Professor Meckel, of Halle, carefully injected the scalps of two persons that died while laboring under the Polish plait, and in neither did he succeed in throwing any of the fluid into the matted mass or horny portion of the hair. These experiments, however, are far from being conclusive; for it is obvious that vessels might have existed in the parts referred to, and yet, owing to their extreme minuteness, the artificial fluid might have failed in reaching them.

When the hairs are plucked out, they are always regenerated, provided the secreting pulp remains unimpaired. When this structure is injured, the new



growth is proportionably slow and imperfect. In old age, the piliferous sacs undergo a sort of *atrophy*; they lose their energy, diminish in size, and are at length completely annihilated. The same phenomenon occurs in certain diseases, as, for instance, bilious fever, scarlatina, psoriasis, and secondary syphilis. The falling of the hairs is often temporary, and probably depends upon some transient disease of the piliferous follicles. A few years ago, a friend of mine, after recovering from a severe attack of scarlatina, lost every hair on the body; in a few months, new ones sprang up, and in time acquired all the characters of the former crop. Persons seldom grow bald all at once. The crown of the head is generally affected first, whence the depilation gradually extends in different directions. The piliferous follicles in this affection seem to die gradually; for, after the original hairs have dropped off, a new crop frequently appears, consisting of a thin, soft, whitish down, evidently formed by feeble attempts at reproduction.

Another affection of the hair is *hypertrophy*. This is most frequently observed on the head, but may also occur on other parts of the body, as the beard and pubes. The most remarkable case of hypertrophy of the hair of the head, of which I have any knowledge, occurred in a friend of mine, a young lady about twenty years of age. From her earliest youth she was subject to cephalalgia, but did not appear otherwise unwell. Her complexion was unusually fair, her eyes light, and her hair of a flaxen hue. In consequence of her constant headaches, the hair was commonly kept short; but, to effect this, as it grew with extraordinary rapidity, it was necessary to cut it every few weeks. Within a year of her death, her general health gradually declined, without any assignable cause, save the astonishing development of the hair, attended with severe cephalalgia. During the last three months, the hair, although it had been cut only a short time before, reached nearly down to the heel, and had a soft, oily feel: the pain in the head increased in violence, the countenance became blanched and almost transparent, and she died gradually exhausted, having, within a few days of her dissolution, exhibited symptoms of acute phrenitis. On examination after death, the only remarkable circumstance observed was a slight accumulation of water in the ventricles and at the base of the brain. It is impossible to doubt that this abnormal growth of the hair depended on hypertrophy of their follicles, inviting constantly an excess of blood to the head at the expense of the rest of the system. This is proved by the extraordinary development of the hair, by the obstinacy of the cephalalgia, and by the symptoms which were present during the last few months of the young lady's illness. The particular state of the piliferous follicles was not ascertained.

Scarcely less extraordinary is the development of the beard in the female. Of this species of hypertrophy not a few examples are recorded by authors. One that came under my own observation I will here mention. The woman who is the mother of a numerous offspring, is seventy-eight years of age, and has always enjoyed excellent health. The sides of the face, chin, and lips are all thickly covered with coarse hair, which she is obliged to shave off regularly once a week. Her whole aspect is remarkably masculine; and, but for the length of the hair of the head, she might be easily mistaken for a male. The hair of the pubis sometimes attains an extraordinary development, forming long, thick tufts; and similar appearances have been witnessed on the shoulders and buttocks.

The hair often loses its normal form, hanging about the head in soft, straight locks. Dr. Elliotson,\* of London, refers to several cases in which the hair

\* Human Physiology, p. 277.

could not be kept in curl if there were the slightest indisposition; and similar examples have been recorded by Alibert and other writers. On the other hand, an instance is narrated in which it always curled in a fit of the gout.

There are cases again, wherein the hair, in consequence of some imperfection in its growth, becomes remarkably brittle. A curious case is recorded by Mr. Mayo\* of a young lady, whose hair, without any assignable cause, suddenly broke, at a quarter of an inch from the head, and fell off in large locks. This singular process was repeated every three or four weeks. She was subject to severe headache, but in other respects her health appeared to be perfectly good.

A change of color of the hair is a natural consequence of old age, but it also occurs in different diseases, and from the influence of the depressing passions, such as grief and fear. What alterations the pilous system undergoes under such circumstances, we have no data to determine. The discoloration, though for the most part gradual, has been known to take place in the course of twenty-four hours. When caused by age, it generally begins at the loose extremities; the same fact is observed in animals which change their complexion for the winter. The restoration of color, on the contrary, always commences at the root.

An accidental development of hairs is not uncommon. This is often seen upon congenital moles, as well as upon parts of the skin that have been for a considerable period in a state of irritation. As occurring in the stomach, bowels, and urinary bladder, numerous cases have been recorded by Haller and other authors. They have also been found in the gall-bladder, in cutaneous tumors, and in the ovary. In the latter organ they generally coexist with dropsical accumulations, carcinoma, or extra-uterine fœtation, and hence they are almost always accompanied by adipocirous matter, by teeth, and by pieces of bone. In most of the situations here specified, though not in all, they perfectly resemble the normal hairs, both in their color and structure, being composed of distinct roots and stems. Concerning their mode of origin, however, we have no positive information; and in the absence of exact facts I refrain from offering conjectures.

## CHAPTER XI.

### OF THE NERVOUS SYSTEM.

#### SECTION I.

##### GENERAL OBSERVATIONS.

- I. *General Observations.*—Cerebral Envelopes.—Cephalo-spinal Liquid.—White and Gray Substances.—Chemical Composition.—Consistence.—Color.—Sensibility.—Vascularity.—Absorbent Vessels.—Speculations of Kellie and Abercrombie, respecting the Compressibility of the Cerebral Tissue.—Weight of the Encephalon and Form of the Spinal Cord.—II. *Lesions of the Cerebral Envelopes.*—Inflammation of the Dura Mater.—Suppuration.—Fibrous Tumours.—Bony Deposits.—Hypertrophy of the Glands of Pacchioni.—Arachnitis.—Hydrocephalus.—Tubercles.—Stages and Symptoms of Arachnitis.—Diseases of the Pia Mater.—III. *Lesions of the Brain.*—Wounds.—Encephalitis.—Suppuration.—Abscesses.—Gangrene.—Softening.—Chronic Inflammation.—Induration.—Ulceration.—Sanguineous Effusions.—Tubercles.—Melanosis.—Encephaloid.—Cartilaginous Formations.—Calcareous Deposits.—Cysts and Hydatids.—Hypertrophy and Atrophy.—IV. *Lesions of the Spinal Cord.*—Inflammation.—Heterologous Formations.—Hydro-rachitis.—V. *Lesions of the Nerves.*—Classification.—Form.—Distribution.—Connection and Structure.—Restorative Power.—Neuritis.—Suppuration.—Ulceration.—Hypertrophy and Atrophy.—Diseases of the Nervous Ganglia.

It will not be amiss, before we proceed to speak of the diseases of the cere-

\* Outlines of Human Physiology, p. 468.

bro-spinal axis, to prefix a short account of the organization and normal characters of this portion of the nervous system, as, without some information of this sort, it will be impossible to place the subject in a proper point of view, or to enable the reader to arrive at a positive conclusion in regard to some of the more intricate topics that are comprised under it. Our materials for illustrating this branch of our inquiry are not of the most satisfactory kind; much remains to be done; the field is almost unexplored, and further investigations are not only necessary, but absolutely indispensable to the true interests of cerebral pathology.

The cerebro-spinal axis consists of three parts, not separate and independent, indeed, of each other, but closely connected together by continuity of substance, namely, the cerebrum, cerebellum, and spinal cord. Situated in the cranial and vertebral cavities, these organs are surrounded by different membranes, and wrought into a variety of figurate bodies, which are perfectly alike on each side of the median line. These structures have always formed an interesting subject of study with the special anatomist; but, as a description of them would be out of place here, it will be sufficient to remark concerning them, that they impart to the cerebro-spinal axis the character of plural organs, each of which, there is every reason to conclude, presides over a particular function, with the precise nature of which we are still unacquainted.

Of the envelopes of the brain and spinal cord, the pia mater, as it is termed, is by far the most important, as it is upon it that the growth and preservation of the nervous substance mainly if not wholly depend. It is in this respect to the parts in question, what the neurilema is to a nerve, or the periosteum to the bones: if a portion of it be peeled off from the surface of one of the hemispheres, the denuded structure will be deprived of its vascular supply, and speedily fall into a state of gangrene. In its texture, this membrane is essentially vascular, the vessels of which it is composed being connected together by the finest cellular substance, which, at the same time penetrates the nervous matter, so as to contribute to its organization. Of the remaining envelopes, nothing need be said here, further than that the one is of a fibrous, the other of a serous nature.

The serous tunic, called, from its excessive tenuity and tenderness, the arachnoid membrane, secretes a thin, limpid fluid, which surrounds the brain and spinal cord, precisely like a sheet of water. The thickness of this aqueous layer is not the same in all parts of its extent. Being from one to two lines on the cerebral hemispheres, it diminishes about the cerebellum, augments at the base of the brain and in the upper part of the neck, decreases again in the back, and finally reaches its maximum in the lumbar region. If an incision be made through the dura mater in the latter situation, the visceral lamella of the arachnoid, from the pressure of the contained water, will protrude across the opening like a hernial bag. None of this fluid naturally exists in the ventricles, or, at any rate, only a very small amount.

The entire quantity of water in the normal state has been estimated at about three ounces. The old have more of it than the young; and it is also said to be more abundant in women than in men. It is of a clear, limpid aspect, slightly saline in its taste, and nearly uncoagulable by heat, alcohol, and acids. When evacuated, it is speedily regenerated, generally within four and twenty hours. The seat of this liquid is the fine, delicate subarachnoid cellular tissue, — a circumstance which serves, in some degree, to distinguish it from that which is poured out upon the free surface of the serous membrane as an effect of inflammatory irritation.

Although the existence of this fluid was announced, in the last century, by



Haller and Cotunni, yet, as it was generally regarded merely as a pathological product, the facts which they communicated concerning it seem to have been entirely overlooked until a few years ago, when the attention of the profession was again awakened to the subject by Magendie. In an able memoir\* read before the Royal Academy of Medicine, at Paris, in June, 1828, this distinguished physiologist has embodied the results of his observations and experiments, from which it clearly appears, that this secretion, instead of presenting itself merely in the form of a halitus, as it was formerly thought to do, always exists in an appreciable condition. He has designated it by the appropriate name of the *cephalo-spinal liquid*; and he supposes that it exerts an important influence upon the function of the brain and spinal cord, since the sudden loss of it in the inferior animals occasions dulness and immobility, which gradually subside as the water reaccumulates.

The brain and spinal cord are composed of two kinds of matter, one of which is of a white appearance, the other of a pale ash color. Upon the minute structure of these substances not a little attention has been bestowed; and, although the attempts that have been made for the purpose of unravelling it have not been altogether unproductive of useful results, yet it must be confessed that many interesting points concerning it are still veiled in obscurity. Until within a comparatively recent period, anatomists generally believed that the two forms of matter exhibited the same structure and arrangement, the only difference consisting, as was alleged, in the greater vascularity of the one over the other. The fallacy of this opinion was first shown by Gall and Reil, who have satisfactorily demonstrated the interesting fact, that the white substance is essentially fibrous, and the grey essentially granular. The texture of both appears to be made up of delicate globules, which are united together by a transparent jelly-like matter, the quantity of which, always small, varies in different parts of the cerebro-spinal mass. Their arrangement in the white substance is linear, so as to give it its fibrous appearance; but, in the grey, they are disposed irregularly, without any assignable order.

The white substance is uninterruptedly continuous in all parts of the nervous system, in which respect it may be said to resemble the cellular tissue, which is uninterruptedly diffused through the whole body. The fibres of which it is composed are, however, much more distinct in some situations than in others, owing either to the fact of their being larger, or, as is not improbable, to the greater laxity of the connecting element. They are made particularly conspicuous by the assistance of such agents as coagulate the albumen which they contain, as alcohol, dilute nitric acid, a solution of corrosive sublimate, or of alum, and by the action of hot oil of turpentine. In many parts, however, they are sufficiently visible without artificial preparation, particularly at the Varolian bridge, the cerebral limbs, the great commissure, and the striated bodies, — structures in which they are uncommonly well developed. The recent researches of Ehrenberg and Raspail countenance the opinion of the existence of two distinct sets of fibres in the white substance; the one being studded with minute knobs, the other, which is the larger, being distinctly tubular, and contained within a granular matter. The first is found in most parts of the encephalo-rachidian mass, as also in the sympathetic cord, the ganglia, and the nerves of the special senses: the latter belongs to the base of the brain, the cerebral crura, the motor nerves of the skull, and the spinal nerves, particularly such as are destined to motion.

\* This memoir has been ably translated by my friend Dr. Joseph Gardner, of Pennsylvania, and published as an appendage to my edition of *Hatlin's Manual of Obstetrics*. Philadelphia, 1828.

The nervous fibres assume two principal directions, the vertical and horizontal. The first are seen in the spinal cord, from which they appear to ascend through the oblong medulla, Varolian bridge, and cerebral crura into the substance of the brain, properly so called. From the cerebral crura they pass along the outer side of the optic thalami, and thence diverge in all directions to reach the convolutions on the surface of the hemispheres. The optic thalami and striated bodies are appendages to this vertical set of fibres, or, in the language of Gall and Spurzheim, they perform the office of ganglia to them. These fibres, it may now be observed, are seen on the anterior part of the spinal cord, and they appear to constitute the pyramidal and olivary tubercles. Another set, ascending along the posterior portion of the cord, pass through the substance of the restiform bodies. Continuing their course, they form the crura cerebelli; after which, passing outwards, they diverge into the lobes of the cerebellum. Thus both the cerebrum and cerebellum are intimately connected with the medulla oblongata; and, by means of two oblique rods of white matter, technically termed the cerebello-testicular processes, with each other.

The horizontal fibres belong exclusively to the encephalon: they are found only in the callous body and the Varolian bridge, in which they run transversely, or nearly so; in the anterior commissure, in which they are arranged obliquely, and in the fornix, in which they run antero-posteriorly. By this arrangement, the ascending fibres, previously described, are brought into intimate relation with the horizontal, which thus subserve the purpose of so many commissures.

The *granular substance* may be likened, in its mode of distribution, to the adipous tissue, as it occurs only in isolated points, whilst the fibres of the other, as before stated, are every where continuous. Investing the surface of the cerebrum and cerebellum, it occupies the central portion of the spinal cord, and is also found in large quantity in the interior of the striated bodies, optic thalami and quadrigeminal tubercles. It enters, moreover, into the composition of the ganglia, and probably also into that of the nerves; at all events, such is the conclusion I have arrived at from personal inspection, and which coincides with the views of Monro, Gall, and several other distinguished anatomists. Much controversy has existed in relation to the intimate nature of the grey matter; but the idea is now pretty generally entertained, that it consists of a plexus of minute vessels, in the meshes of which is an irregular granular pulp, which assumes a somewhat fibrous arrangement as it approaches its junction with the medullary substance.

Modern *chemistry* has ascertained that the nervous substance is a peculiar compound, unlike any of the other constituents of the body. Water and albumen appear to be the principal ingredients; it affords, besides, various fatty matters and cholesterine; it also contains sulphur, phosphorus, and a small amount of osmazome. It is to the presence of albumen that the nervous substance owes its coagulability on being immersed in alcohol, a solution of oxymuriate of mercury, or any of the dilute mineral acids. It is readily decomposed by exposure to a moist atmosphere; and, when put in water, it is gradually converted into a greenish putrilage, remarkable for its fetid exhalation.

The *consistence* of the cerebro-spinal mass varies not only in different parts of its extent, but at different periods of life, and under different circumstances of health and disease. In regard to the granular and fibrous substances, the latter, it is well known, is always more firm and resisting than the former, which is generally so soft, no matter in what situation it be examined, as to be readily crushed by the slightest pressure. This is particularly true of the

granular texture of the cerebellum, the cohesive power of which is invariably less than that of the brain, properly so called. The term pulpy, which was until recently employed to designate this form of nervous matter, is sufficiently expressive of its normal consistence.

The fibrous substance is comparatively firm, and, when recent, even elastic. Broad, thin slices of it, from one to two lines in thickness, generally possess a sufficient degree of tenacity to resist laceration: a keen knife is necessary to divide it, and the cut surface is usually somewhat rough. Exposed to putrefaction, the fibrous substance resists its invasion much longer than the granular, nor does it lose so much of its weight by desiccation. But in pure water it retains its consistence unaltered during a period varying from eight to twelve hours: subsequently it begins to soften, and, in the course of a few days, it is converted into a pulpy, greenish, and offensive mass.

In the cerebrum the white substance is remarkably firm in the great commissure, the annular protuberance, and the ascending crura,—parts, it will be remembered, in which the fibrous structure is unusually distinct and well developed. The interventricular septum, the fornix, and optic thalami, together with some of the other figurate bodies in the lateral cavities of the organ possess very little tenacity, and are frequently so soft, even within the range of health, as to render it difficult to demonstrate them. In the cerebellum, the substance in question is more firm and dense in the diverging crura and the ascending processes, than in any other situation. Of the spinal cord, the oblong and cervical portions are the hardest and most resisting.

As was before stated, the consistence of the encephalo-rachidian mass varies considerably in the different periods of life. In the new-born infant, the component elements are soft and pulpy, like well-boiled pap, mashed turnips, or warm custard: they readily receive the impression of the finger, cannot be easily cut, except with a very sharp scalpel, and are freely impregnated with viscid serosity. By and by they acquire greater firmness and tenacity; the interstitial fluid diminishes in quantity; the line of demarcation between the white and grey substance becomes more conspicuous; the figurate bodies are distinctly mapped out, and the whole mass is now compressible and elastic, but still too soft to bear much handling. At what period the several organs acquire their maximum of consistence, is a point which can only be settled by future observation: judging from my own dissections, I should think this did not occur in the generality of cases, before the eighteenth year. In old age, the cerebro-spinal axis is commonly remarkably hard and firm, in accordance with the law of the animal economy, by which the organs and textures are drained of their interstitial juices.

Concerning the *color* of the cerebro-spinal mass, not much need be said in this place. In the fœtus and new-born infant, the two substances are so nearly alike in their complexion as to render it difficult to distinguish them from each other,—a circumstance which has given rise to the idea, so warmly advocated by Gall, Spurzheim, and Tiedemann, that they are not of simultaneous formation. As life advances, the lines of distinction become more abrupt, and the component elements assume the peculiar hues which characterize them in the adult.

The intensity of color of the granular texture is influenced by a variety of causes, the principal of which are referable to age and health. In early life, it is of a light rosy tint, which is gradually changed into a cineritious complexion. In very old people, I have frequently seen this substance exhibit a drab-colored aspect, probably from the obliteration of some of its capillary vessels, followed by a diminution of blood. In dropsical subjects, and in



such as are habitually bled, or exposed to profuse evacuations, of whatever kind, the grey color is much less intense than in such as are healthy; in many cases, indeed, it is nearly lost, the whole cerebro-spinal mass presenting a remarkably blanched appearance. The fibrous texture is not so clear in children as in adults; and, in the aged, it is often of a milky white. In protracted jaundice, both substances have repeatedly been found of a light yellowish hue. Several examples of this kind have fallen under my own notice.

We may conclude, from the investigations of Sir Charles Bell, and other physiologists, that the cerebral matter, in its normal condition, is insensible, but that, when it is inflamed, it becomes extremely painful. It has not been determined whether in the latter state the suffering should be referred to the sensibility of the connecting cellular tissue, the distended vessels, or the compressed nervous fibres and granules. These are points which it is difficult to ascertain, and concerning which, in the absence of positive facts, it would be idle to speculate. The spinal cord appears to possess a different kind of sensibility, experiencing, when cut or pricked, the same feeling as a nerve.

The cerebro-spinal axis is amply supplied with blood, more so, undoubtedly, than any other parts of the body. The amount of fluid distributed to the encephalon alone has been estimated at about one-fifth of the entire circulating mass. This estimate probably exceeds the truth: the quantity is very great in proportion to the size of the organ; but, as it does not admit of accurate appreciation, no satisfactory statement can be made respecting it. The arteries engaged in carrying on the cerebral circulation are the vertebral and internal carotid, the first of which enter the base of the cranium at the occipital foramen, the other at the carotid canal in the petrous portion of the temporal bone. Having sent branches of intercommunication, the passage of which is extremely tortuous, they immediately separate into an infinite number of twigs, which penetrate the surface of the brain in the form of capillaries, — an arrangement which is of essential importance, when we consider the excessive delicacy of the nervous substance, and the immense amount of blood pervading it.

The precise arrangement of the arterial capillaries in the cerebral substance, is not known: they traverse the organ in every conceivable direction, and at length terminate in corresponding veins, which, after forming a network on the surface of the brain, finally open by eight or ten trunks into the sinuses of the dura mater.

No absorbent vessels can be detected in the cerebro-spinal axis. That they exist here, however, as elsewhere, is abundantly proved by what occurs in apoplectic individuals. In cases of this kind, the effused blood undergoes a series of changes which can only be accounted for on the assumption that there are appropriate absorbent agents. The red particles are gradually carried away, and the fibrinous mass, which is at first hard and solid, is finally wrought into a delicate cellular texture, the meshes of which are filled with yellowish serosity.

In dismissing this branch of our subject, it will be necessary to say a few words in relation to the speculation of Kellie, Abercrombie, Clutterbuck, and others, that the encephalon uniformly contains the same amount of blood, no matter what may be the quantity of this fluid in other parts of the body, whether normal, increased, or diminished. The proposition of these pathologists is founded on the assumption that the organ in question is not only incompressible, but wholly removed from the influence of the atmosphere, and that it always accurately fills the cranial cavity. From these physical conditions, it follows, they allege, that no material variation can take place, within

a short time, in regard to the absolute quantity of blood in the brain; or, what is the same thing, that there can be no actual plethora or anemia; and hence venesection, to whatever extent it be carried, can affect the cerebral circulation only secondarily, indirectly, or consecutively, that is to say, only by lessening the force of the heart. Granting that the encephalic mass is entirely incompressible, as its very composition, indeed, abundantly proves, the idea that it accurately fills the cavity of the skull, and is completely protected from the pressure of the atmosphere, is, I presume, a mere assumption, and susceptible of easy refutation.

That there is a vacuity between the skull and the surface of the brain, or, in other words, that these parts do not lie in actual and close contact, is a fact with which every one is familiar. During health, when the circulation is in full activity, this space is small; but, in certain pathological states, as well as after death, it is often quite considerable, and admits of ready demonstration. But for its existence, no effusions could take place into the arachnoid sac, on the surface of the cerebral hemispheres, the ventricular cavities, or at the base of the cranium; unfortunately, however, this is not the case; for not only are such effusions very common, but they frequently exist to a very great extent. Add to this, that the brain is in a state of constant locomotion, and there can be no difficulty in forming a correct conception of the vacuity under consideration. This movement is very apparent at the fontanelle of the infant, and is often seen in injuries of the skull, attended with a loss of osseous substance: it is connected with respiration, and is characterized by a distinct rising and falling of the encephalic mass, produced, probably, by atmospheric pressure.

But it is alleged, secondly, that the brain is completely withdrawn from the pressure of the atmosphere. This view is only partially correct. There is, we admit, no pressure exerted above and at the sides of the cranium, but there certainly is below; so that, in this respect, the brain is circumstanced pretty much as the thoracic and abdominal viscera, which are subjected to the influence of the atmosphere only in certain directions, not in all.

Thirdly, the experiments performed by Dr. Kellie, with the hope of illustrating this subject, are anything but conclusive. The turgescence of the cerebral vessels observed by this physician in animals after being bled to death, I have often noticed myself; but it is by no means, as he supposes, peculiar to the encephalic mass. The other internal organs usually participate in the plethora, which is sometimes so great that the blood will escape in considerable quantity upon the slightest pressure. This is especially true of the liver, spleen, lung, and kidney. In these structures, as I have frequently had occasion to observe at our slaughter-houses, the vessels are as well filled as those of the brain; sometimes, indeed, much more so.

Nor is it generally true, as has been affirmed by Kellie and Monro, that, after strangulation, the vessels of the brain retain their normal appearance. Every one knows that, in the majority of instances, the reverse is the case. In twelve experiments, which I performed some years ago, on manual strangulation, the cerebral capillaries were every where deeply injected, the larger sinuses distended, and the vessels of the pia mater completely engorged. The subjects were dogs and rabbits; and the hand was applied directly over the carotid arteries and jugular veins, until the animals ceased to breathe, — a circumstance which fully accounts for the plethoric condition of the encephalic mass. In none of the cases was there any extravasation of blood.\* Similar

\* See the author's paper on Manual Strangulation, in *Western Journal of the Medical and Physical Sciences*, vol. ix., p. 25.

effects are produced in strangulation from suspension, excepting where the cord happens to be so placed as not to interfere materially with the return of the blood from the head to the heart.

But, independently of these facts, of the truth of which any one may easily satisfy himself, daily observation fully disproves the conjectures of the British pathologists. In protracted abstinence, the brain invariably partakes of the general deficiency of sanguineous fluid, becoming abnormally pale, and otherwise altered; and similar phenomena are often witnessed in anemia, whether produced by innutritious diet, starvation, or lingering disease. In such cases, dissection rarely reveals any serous effusion. Analogous effects are frequently caused by excessive bleeding. Every practitioner must have met with instances of this kind. A most interesting one came under my notice several months ago. A gentleman, forty-four years old, was seized with symptoms strongly denoting cerebral apoplexy, for which he was bled, at different operations, to the amount of nearly six pounds, before his pulse began to flag. Under this treatment, assisted by purgatives, and external irritants, his sensibilities were to a certain degree restored, and in about thirty-six hours he began to speak. In a short time, however, his mind became greatly excited, and at intervals he raved under the most furious delirium. Finally, convulsions set in; and, after repeated attacks of this kind, he fell into a comatose condition, and expired on the fourth day of his illness. On examination, I found all the internal viscera in a state of complete anemia, excepting the spleen, which was somewhat engorged as the effect of previous irritation. The brain, which was supposed to be the chief seat of the disease, was remarkably blanched, and every capillary appeared to have been drained of blood: the vessels of the pia mater were empty, and the larger sinuses contained only a few drops of thin, claret-looking fluid. A small quantity of serum, altogether not exceeding two ounces, existed in the ventricles and at the base of the brain.\*

From the foregoing facts, and the reasoning founded on them, we are fully warranted, I think, in concluding that, although the brain itself is really incompressible, and in some degree beyond the influence of atmospheric pressure, yet, notwithstanding all this, the amount of blood sent to it is liable to the same variation as in other parts of the system, and that it may consequently be diminished in the same ratio by bleeding, low diet, and other depletory measures. If this deduction be true, as there is just grounds to believe it is, the conjecture of Abercrombie and Clutterbuck, that we cannot lessen the quantity of blood in the head, in any material degree, by our evacuations, resolves itself into a "baseless fabric," void even of the shadow of proof.

The preceding sketch of the organization of the nervous texture would be incomplete without adding a few remarks on the *weight* of the encephalon, and the *form* of the spinal cord. It need scarcely be stated that the size of the cerebrum and cerebellum is always in direct ratio to the magnitude of the bony case which encloses them. The mean weight of these masses has not yet been determined, nor is this a matter which, in a pathological point of view, is of much moment, since it is generally very easy, for one accustomed to making examinations, to discern the boundary which separates the normal from the abnormal state. In six adult brains, I found the mean weight of the cerebrum to be two pounds, five ounces,—the minimum three ounces less, and the maximum four more. In the same cases, the average weight of the cerebellum was six ounces, the minimum four ounces and a half, and the maximum eight ounces. The annular protuberance, placed between the cerebrum, cerebellum,

\* Western Journal of the Medical and Physical Sciences, No. liv., p. 513.



and oblong portion of the spinal cord, forms about the sixtieth part of the central mass. In the fœtus and child, the cerebellum is proportionably larger than subsequently; and the same holds good in regard to the encephalon as compared with the rest of the body.

The following table, constructed by Dr. John Sims,\* of London, exhibits the average weight of the brain in two hundred and thirty-seven cases. The weight used was avoirdupois.

Years.	Number of Cases.						Average Weight.
1 to 2	-	-	-	9	-	-	- 2 lb. 1 oz.
2 to 3	-	-	-	3	-	-	- 2 4 $\frac{1}{3}$
3 to 4	-	-	-	5	-	-	- 2 6 $\frac{1}{3}$
4 to 5	-	-	-	3	-	-	- 2 7
5 to 10	-	-	-	9	-	-	- 2 8 $\frac{2}{3}$
10 to 15	-	-	-	14	-	-	- 2 12 $\frac{4}{14}$
15 to 20	-	-	-	3	-	-	- 2 13
20 to 30	-	-	-	19	-	-	- 2 12 $\frac{4}{19}$
30 to 40	-	-	-	22	-	-	- 2 13 $\frac{2}{22}$
40 to 50	-	-	-	29	-	-	- 2 14 $\frac{2}{29}$
50 to 60	-	-	-	35	-	-	- 2 13 $\frac{2}{35}$
60 to 70	-	-	-	42	-	-	- 2 11 $\frac{4}{42}$
70 and upwards	-	-	-	44	-	-	- 2 10 $\frac{5}{44}$

The inference from this table is, that the average weight of the brain goes on increasing from the first to the twentieth year; between twenty and thirty it slightly diminishes; afterwards it augments, and reaches its maximum between forty and fifty. From fifty to old age, the organ gradually decreases in weight. Sir William Hamilton finds that the average weight of the adult male brain is 3 lbs. 8 oz., troy, that of the female 3 lbs. 4 oz.; a result which nearly agrees with that of Dr. Sims.

In the adult, the spinal cord extends from the inferior border of the Varolian bridge as far as the level of the first lumbar vertebra. Occasionally it reaches a little lower down; and, in one instance, Keuffel saw it end opposite the eleventh bone of the back. Its length may thus be said to vary from sixteen to twenty inches, according to the stature of the subject. In its general outline, the cord is nearly cylindrical, its transverse diameter, however, being somewhat greater than the antero-posterior, which gives it rather a flattened appearance in the former direction. Its thickness, which is scarcely half an inch, is not uniform, from one extremity to the other. Three distinct swellings are observable in different parts of its extent. Inferiorly, it is enlarged just before it terminates, in the caudal prolongation: the second expansion corresponds with the interval between the third and sixth cervical vertebræ; and the third forms what is termed the oblong medulla, which is properly only the commencement of the cord.

The cranial portion of the cord, usually called the oblong medulla, is of a flattened cylindrical form, being broad and thick, superiorly, near the Varolian bridge, but tapering gradually towards the occipital foramen. Two longitudinal grooves, continuous with those of the cord below, and situated, the one on its anterior, the other on its posterior aspect, divide this swelling into two symmetrical parts, each of which consists of three distinct nodules, namely, the anterior pyramid, the olivary tubercle, and the restiform body. A transverse

\* Medico-Chir. Trans. of London, vol. xix., p. 359.

section of these prominences shows them to be composed of granular matter, invested by a thin lamella of white substance, the fibres of which pass the two median grooves obliquely, and so a decussation is produced between them. This intercrossing, which is very perceptible at the lower portion of the oblong medulla, enables us to account for the singular fact — at one time altogether inexplicable — why a lesion of one side of the encephalon leads to paralysis and loss of sensation of the opposite side of the body.

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## SECTION II.

### OF THE CEREBRAL ENVELOPES.

I. The dura mater is susceptible of *inflammation*. The disease generally occurs in irregular circumscribed patches of greater or less size, and but rarely exists, excepting as a consequence of external injury. When thus affected, many extremely fine vessels, filled with florid blood, are seen in the dura mater, running in beautiful arborescent lines. Often the redness exhibits a peculiar bluish tint, not unlike what we see in sclerotitis; and, although the injection is sometimes remarkably great, yet the inflamed portion is never so much crowded with capillaries as other membranes are which are naturally more vascular. In most cases, the inner surface of the dura mater is covered with small masses of lymph; and, not unfrequently, it is lined by a tolerably thick, adventitious membrane. In this manner, extensive adhesions may be produced between it and the other tunics, or even between it and the convoluted surface of the brain.

*Suppuration* of the dura mater is seldom, perhaps never, met with, excepting as a consequence of external violence. The matter is commonly deposited upon the inner surface; but instances have been witnessed in which it was found between its layers, or upon its outer surface. In the latter case, when the fluid is considerable, long retained, or of an acrid quality, it may erode the membrane and escape into the arachnoid sac. Occasionally, too, it produces caries, and perforation of the cranial bones; but such occurrences must be extremely infrequent.

Various are the morbid changes which result from *chronic inflammation* of the dura mater. Of these, the most important, however, are thickening, fibrous growths and ossification. The thickening, which is almost always conjoined with induration, varies extremely in degree, and is sometimes so great as to occasion symptoms of cerebral pressure. Bonetus mentions an instance where it was nearly half an inch; and similar examples are recorded by others. It is sometimes found in fatal cases of epilepsy and paralysis. In one instance which fell under my notice not long since, the thickening was connected with caries of the frontal bone, the membrane presenting a very rough, fungous appearance. The reverse of this state is sometimes observed, the dura mater being remarkably thin and attenuated.

*Fibrous tumors*, of the size of a small nut, sometimes grow from the dura mater, generally from its inner surface, to which they either adhere by a narrow foot-stalk, or, as is sometimes the case, by a broad base. They are of a greyish color, of a dense, fibrous texture, hard, inelastic, and seldom acquire any great bulk.

One of the most common morbid appearances of the dura mater, as has been

Fig. 102.



observed by Dr. Baillie, is the formation of thin plates of bone. These I have very frequently observed, and am inclined to regard them as originating rather in the subserous cellular tissue, than in the substance of the membrane itself. They are most commonly noticed in the great falciform process, where they occur in small, irregular masses, not larger than a finger-nail. In several instances, however, I have seen them of the size of a Spanish dollar; and cases are given, in which the ossification occupied nearly the whole of the dura mater of one hemisphere. These bony plates are generally very hard, of a yellowish color, more or less rough on the surface, and, when sawed, they occasionally exhibit a real porous structure, like the osseous tissue in other parts of the body. Fig. 102 re-

presents several plates of this kind on each side of the longitudinal sinus. The drawing is from a preparation in the museum of the Institute.

Various other kinds of morbid growths and depositions are described by authors as being occasionally found in the dura mater; but their occurrence is so extremely rare, and their nature so little understood, that it is not worth while to give any account of them in this place.

The *Pacchionian glands* are occasionally much enlarged, indurated, and changed to the appearance of grumous blood. The *sinuses* of the dura mater are also sometimes diseased. The most frequent affection, by far, is inflammation of their lining membrane. When thus affected, the serous tunic is unnaturally vascular, opaque, covered with lymph, slightly thickened, and occasionally even ulcerated. Ribes and Tonellé tell us that they have sometimes seen the sinuses partially filled with pus; and nothing is more common than to find them obstructed with firm, dense, fibrinous concretions.

II. *Arachnitis* being a disease of very frequent occurrence, it will be necessary to dwell upon it at some length. The most important anatomical characters of the acute form are increase of color, opacity, thickening, and preternatural firmness, with effusion of serum, lymph, pus, and sometimes even of blood. In the early stage of the disease, the membrane does not present any perceptible alteration, but remains thin and transparent as in the normal state; and, what is remarkable, the pia mater is almost always affected first, being usually thickened and deeply injected, long before any change can be recognised in the arachnoid itself.

All parts of the arachnoid do not seem to be equally susceptible of inflammation. The portions most frequently implicated are those in the ventricles of the brain, on the convexity of the hemispheres, at the base of the cerebellum, the junction of the optic nerves, the Varolian bridge, and lastly, at the internal flat surface of the hemispheres. Such, at least, is the result of



my own observations corroborated by that of some of the most distinguished pathologists of the age.

The redness of the arachnoid is usually limited in its extent, being restricted to a few points on the convexity of one or both hemispheres, at the base of the brain, or between the lobes of the cerebellum. Occasionally, when the inflammation is very intense, the redness occurs in pretty large patches, and appears to be caused by a real extravasation of blood; but, even under these circumstances, it is quite impossible to trace any vessels into the affected membrane; and hence I am inclined to think that Dr. Hope and others who have delineated such vessels are in error, — believing that they belong rather to the pia mater and the connecting cellular tissue than to the arachnoid itself. What strengthens this opinion is, that the color may frequently be removed by scraping the part with a scalpel, or exposing it for a few minutes to a gentle current of water; which could not be effected, did it exist in the substance of the membrane.

With this augmented vascularity, if such it may be styled, is usually conjoined, at an early period of the disease, a loss of the natural transparency. At first there is merely a slight degree of opacity, scarcely appreciable without the closest examination; but, by degrees, the membrane assumes a whitish, milky aspect, interspersed, not unfrequently, with shining pearly specks, and small patches of red. Cases are recorded in which the arachnoid is said to have exhibited a dark mottled appearance; but of this I have never seen an instance.

After the disease has existed for some length of time, especially if it have been very violent, the membrane is found to have a real increase both of thickness and of density, so that it may be easily detached from the surface of the brain, and even from the dura mater. These changes, although they sometimes occupy a considerable extent of surface, usually occur in small patches, which are confined to some parts of the upper surface of the hemispheres, the cerebellum, or base of the cerebrum. In cases of this kind, the pia mater is not only deeply injected, but the cellular tissue between it and the arachnoid is infiltrated with various kinds of fluids, such as serum, lymph, blood, and occasionally even with pus. These substances may all be witnessed at the same time; but, in the generality of instances, the first two alone are met with. Occasionally, the subarachnoid tissue is emphysematous, — from what cause it is unknown.

The effusion of serum is sometimes very copious; and, in parts where the subarachnoid cellular tissue is very loose and abundant, as, for example, in the integral spaces, at the fissure of Sylvius, the Varolian bridge, and the junction of the optic nerves, the distension may be so great as to raise the membrane in the form of considerable vesicles, of a gelatinous appearance. In quantity, it may vary from a few drachms to several ounces, being always more copious in the ventricles than on the surface or base of the brain. In its appearance, it is usually limpid, but now and then opaque and milky, from the admixture of lymph. When the inflammation is very severe, we sometimes meet with deposits of pure blood, either in the subarachnoid cellular tissue, in the substance of the pia mater, or in the intergyral spaces. The presence of puriform fluid is always indicative of high vascular excitement, and frequently attends wounds, contusions, and other lesions of the head. Dryness of the arachnoid is occasionally observed, generally in small patches, of a hard, shrivelled aspect. Their presence always denotes excessive cerebral irritation.

The deposition of lymph is much less frequent upon the surface of the arach-

noid than upon that of the pleura or peritonæum. That it is very often met with, however, every anatomist, at all in the habit of making necroscopic examinations, must be fully aware. Nor is the effusion of lymph always confined to the free surface of the membrane. In the majority of cases, indeed, it occurs in the subjacent cellular tissue, where it is frequently seen of great extent, communicating a yellowish tint to a large portion of the hemispheres. In some instances, it follows the course of the pia mater, producing adhesion between the convolutions, and filling up the intervals between them: occasionally, though rarely, it is witnessed in the ventricles, covering the choroid plexus; and a very common seat of it, according to Abercrombie, is the superior surface of the tentorium. In its color, this deposit is generally more or less opaline, with various shades of green and yellow.

When occurring upon the free surface of the arachnoid, the lymph is often moulded into a distinct membrane, the thickness, color, and consistence of which are much influenced by the length of time it may have existed, no less than by the violence and extent of the inflammation. In a stout athletic man, thirty-five years of age, who died of acute meningitis, brought on by a most extensive fracture of the skull, the exudation, which covered the greater part of the right hemisphere, was about the thickness of a common wafer, of a pale straw color, inclining to greenish, and of the consistence of the buffy coat of the blood, before it has undergone perfect coagulation. The rapidity with which this deposition may take place is strikingly exemplified in the case before us, in which the patient expired in less than three days from the occurrence of the accident. In instances of long standing, the color is usually lighter, the consistence more firm, and the thickness greater. I have never seen these adventitious membranes organized; but Dr. Hooper has delineated one which is beautifully transparent, and abundantly supplied with vessels from the dura mater.

It does not seem to have been known until a few years ago that acute meningitis is generally dependent upon the development of tubercles in the substance of the pia mater, underneath the arachnoid membrane. In 1827, Guersent published, under the title of "*Meningite Granuleuse*," a number of cases, the most prominent pathological character of which was the presence of whitish or greyish granulations, similar to those observable on the pleura and peritonæum. Papavoine, in 1830, was the first to demonstrate the true nature of these bodies, and to indicate their co-existence with tubercles in other organs. The results of his researches were soon after verified by those of Fabre, Constant, Rufs, Green, Piet, Coignet, Lediberder, Becquerel, and Gerhard. The paper of the American inquirer was published in 1834, and materially contributed to settle the question as to the particular origin of this disease.

The morbid alterations of this form of meningitis are generally well characterized. The tubercles are seated in the substance of the pia mater, beneath the arachnoid, to the inner surface of which they usually adhere. They are commonly most numerous along the course of the large vessels on the hemispheres and at the base of the brain, particularly in the fissure of Sylvius. In their size they vary from that of a grain of sand to a millet-seed, which latter they seldom reach, and never exceed. They are rounded or flattened, of a whitish, opaline, or greyish tint, semi-transparent, and generally isolated, or disseminated, but sometimes grouped. Their consistence ranges from semi-concrete lymph to fibro-cartilage. The older granulations are commonly opaque, hard, of a pale yellowish color, and firmly adherent to the parts in which they are developed.

The arachnoid is ordinarily free from adhesions, smooth, and more or less transparent. Its surface may be dry or moist, and in many cases it is covered with a viscid, glutinous, or sticky secretion. The pia mater, the principal focus of the disease, is preternaturally red, gorged with blood, and infiltrated with serosity. When the latter exists in considerable quantity, it is often of a greenish complexion, and of a thick, jelly-like consistence. The larger, as well as the smaller vessels, on the surface of the brain, are generally excessively distended, especially when the tubercles are numerous, and the disease has been unusually tardy in its progress.

Along with these changes there may be deposits of lymph on the free surface of the arachnoid, more or less flattening of the convolutions of the brain, ramollissement of the figurate bodies, and effusion of serosity in the ventricles. The degree of softening varies in different cases, and is always most conspicuous in the fornix and septum lucidum, which are occasionally converted into a white, pulpy, diffuent substance, of the consistence of thick cream or thin starch. In some rare cases the softening extends to the striated bodies and optic couches. The serum in the ventricles varies from two or three drachms to several ounces; it is commonly clear and limpid, like well water, but now and then it is turbid, or white and milky, especially when there has been considerable inflammation of the choroid plexus. I have never met with purulent matter in this form of the disease, but such an occurrence has been noticed by others.

Tubercles of the subarachnoid cellular tissue usually coexist with similar deposits in the lungs and lymphatic ganglia. This is particularly true of infants; in adults the coincidence is less frequent. The disease may occur at any period of life, but is most common from six to ten years, then from three to five, next from eleven to thirteen, and finally from one to two. Rilliet and Barthez suppose that boys are more liable to it than girls; but this is still an unsettled point. Like tubercular formations in other parts of the body, it is occasionally hereditary. Death may occur from a few days to several weeks. Of one hundred and seventeen cases mentioned by Mr. Green, of London, thirty-one terminated in seven days, forty-nine in fourteen days, thirty-one in twenty days, and six after this period. The disease sometimes pursues a strictly chronic march.

Such are the principal anatomical features of the two forms of acute arachnitis. In the chronic variety the alterations are still more diversified, consisting of more or less thickening and opacity of the arachnoid and pia mater, increase of firmness and tenacity, organized adventitious membranes, tubercles, cartilaginous and osseous concretions, and, in some cases, of copious effusions of serum, — giving rise to what is named *hydrocephalus*. In acute arachnitis, as has been stated, the quantity of serum seldom exceeds two or three ounces; in chronic, on the contrary, it is always very considerable. I have myself, in several instances, removed nearly two pints of fluid; and cases are narrated in which the amount was much greater. Thus, Dr. Horner mentions an instance in which the lateral ventricles alone contained five pints; and Fabricius Hildanus gives another, in which the quantity was upwards of two gallons. Chronic hydrocephalus not unfrequently exists as an intra-uterine affection; more commonly, however, it makes its appearance soon after birth, and goes on progressing until the head attains an enormous development, out of all proportion to the rest of the body.

The fluid of hydrocephalus is generally perfectly clear and limpid, possessing, indeed, very much the same qualities as the serum of the blood, from which it is derived. In most cases, it is without smell and without taste, though the



latter is sometimes slightly saline ; and, by exposure to heat, I have, in several instances, found it as perfectly coagulable as the water of ascites, hydrothorax, or hydrocele. It may be stated, however, as a general proposition, that the quantity of albumen is much less than in peritonæal and other serous effusions ; and hence heat, alcohol, and acids seldom exert upon it the same marked effect.

The specific gravity of this fluid, according to Dr. Trail, of Liverpool, is a little greater than that of common water, in the proportion of about a twentieth part. The best analysis that we have of it is by Dr. Marcet, who found the solid contents of one thousand grains of the fluid of the ventricles to consist of —

Water	-	-	-	-	-	-	-	990.80
Muco-extractive matter, with a vestige of albumen	-	-	-	-	-	-	-	1.12
Muriate of soda	-	-	-	-	-	-	-	6.64
Subcarbonate of soda, with a vestige of an alkaline sulphate	-	-	-	-	-	-	-	1.24
Phosphate of lime, with traces of phosphate of magnesia and iron	-	-	-	-	-	-	-	20
								<hr/> 1000.00

The fluid of congenital hydrocephalus has been recently analyzed, with great care, by Dr. B. G. Babington, of London, who states its specific gravity to be 1004. It does not coagulate by heat, alcohol, or acids, and consequently does not contain, as he supposes, albumen. Instead of this substance, he detected a very minute quantity of gelatine.

Chronic hydrocephalus is usually connected with softening of the cerebral tissue, which is not unfrequently quite pulpy and reticular. The parts most commonly affected are the great commissure, fornix, and interventricular septum. In young children, who are mostly the subjects of this accumulation, the bones of the skull are often widely separated, the brain unfolded, and the whole head remarkably distorted. In a case which I recently examined, a considerable number of minute apoplectic effusions were discovered, for the most part in the right cerebral limb, just in front of the Varolian bridge, where there were as many as ten or a dozen.

The ventricles of the brain are variously affected. When the quantity of fluid is considerable, they are expanded into large sacs, frequently lined by a thin layer of lymph, into which vessels may be seen dipping from the subjacent parts. In such cases, the figurate bodies of the brain are sometimes wholly destroyed, the convolutions effaced, and the grey substance compressed, as it were, into a thin shell, occasionally not more than half a line in thickness.

Arachnitis presents three stages, each of them characterized by a distinct group of symptoms. The first comprises the period of cerebral excitement, and is marked by increased sensibility to all sorts of impressions, with irritability of temper, headache, flushed cheeks, grinding of the teeth, knitting of the eyebrows, wakefulness, a quick, jerky pulse, and irregularity of the bowels.

In the second stage, which constitutes the period of reaction, or, more properly speaking, that in which the cerebral irritation is propagated to the muscular and nervous systems, the diagnostic characters are, great restlessness, agitation, and convulsions ; torpor of the bowels, nausea and vomiting, particularly on assuming the erect posture ; intense headache, loss of memory, altered pronunciation, intolerance of light and sound, with quick pulse, hurried

respiration, a circumscribed flush on one cheek, and general fever. The convulsions are commonly long and severe; and it is not undeserving of notice, that, when the arachnitis is seated on the convex surface of the cerebral hemispheres, delirium sets in very early, and becomes the prominent and characteristic symptom; whereas, if it occur at the under surface and base of the brain, coma is the more usual attendant. The duration of this stage varies from a few days to a week or more.

The third stage, which is that of collapse, is marked by immobility of the pupils, loss of sensation, more or less hemiplegia, strabismus, paralysis of one or both eyelids, constant somnolency, oblivious state of the intellect, and convulsive twitchings of the muscles of the face, the trunk, or extremities. The third stage lasts from a few hours to three or four days.

The symptoms of chronic arachnitis, at the commencement, are generally not very well marked; they all, however, partake of the character of those mentioned as indicating the acute variety of the disease. Usually, the patient experiences some difficulty in articulating words; he is forgetful, his ideas are incoherent, and his whole gait is unsteady and vacillating; the limbs are frequently agitated with convulsive tremors; and the intellectual disturbance, although slight at first, is regularly progressive, until at length it terminates in confirmed idiocy. Delirium and progressive paralysis are, according to Bayle, the constant attendants on chronic arachnitis.

The arachnoid, like other serous sacs, is liable to effusion of *blood*. The occurrence is chiefly met with in children under two years of age, in whom, in fact, it constitutes by far the most common form of cerebral hemorrhage. It was nevertheless almost entirely overlooked by pathologists, until a few years ago, when it was investigated, first by Becquerel,\* immediately afterwards by Legendre,† and very recently by Rilliet and Barthez.‡ The latter inquirers have published the results of twenty cases, of which seventeen came under their own observation. The most common site of the effusion is the convex surface of the brain; it may, also, occur on the plane surface of the cerebrum, but never on that alone. It is usually present on both hemispheres, is not more frequent on one side than on the other. The blood is seldom found in a pure or in an unaltered state; on the contrary, it speedily separates into serum and crassamentum, the latter of which, in a short time, assumes the form of a clot or layer, of a black, dark red, brownish, or pale yellowish color. This clot is thicker at the centre than at the circumference, irregular in its shape, lacerable, and from a few lines to several inches in diameter. One surface is commonly free, while the other almost always adheres to the parietal layer of the arachnoid, from which, however, it is easily detached, leaving the part with which it was in contact smooth, polished, and unaltered. The number of clots is various; sometimes there is only one, at other times there are several. In either case, they usually coexist with a thin, yellow, or transparent membrane, with the edges of which they are insensibly blended. Whether this membrane, which is sometimes opaque, firm, and pearly, like the dura mater, is produced by a deposit of plastic lymph, or whether it is caused simply by the transformation of the effused blood, is not satisfactorily determined. Their continuity would seem to point out their common origin. In the adult the membrane has been observed, in a few rare instances, to have a distinctly stratified structure, indicating that there were several successive depositions of blood.

\* Clin. des Hôpitaux des Enfants, Avril, 1842. Brit. and For. Med. Review, April, 1844, pp. 302-553.

† Revue Médicale, Dec. 1842, and Feb. 1843.

‡ Traité des Maladies des Enfants, t. ii., p. 29.

When this adventitious membrane adheres, as it sometimes does, to both surfaces of the arachnoid, it may be converted into a sort of cyst, which usually contains from a few drachms to several ounces of clear, limpid fluid. When the quantity is more considerable, the fluid will necessarily, on the one hand, compress the brain, and, on the other, distend the yielding walls of the cranium, producing thus a translucent, fluctuating tumor, either diffused or circumscribed, very similar to that of ordinary chronic hydrocephalus. In this way the disease may ultimately prove fatal, or the accumulated water may be absorbed, and the cavity of the sac be obliterated.

III. The *pia mater*, considered separately, is not, on the whole, very often diseased. In arachnitis, it is not unusual, as was before stated, to see its substance inflamed, and its vascularity greatly augmented, with small masses of lymph adhering to its surfaces, especially the outer. Under these circumstances the vessels of the *pia mater* are unnaturally conspicuous, are filled with florid blood, and form, by their anastomoses, a beautiful network. Most generally, this augmented vascularity occurs in considerable, large patches; which are often of a bright red color, and easily detached from the convolutions of the brain. Small sanguineous effusions are occasionally observed; and, in some instances, the part presents an ecchymosed or bloodshot aspect. When the *pia mater* is inflamed to a high degree, pus is commonly formed, which may spread over the whole upper surface of the brain, or finally erode the membrane, and get in contact with the cerebral tissue. Ulceration and mortification, however, are rare consequences of inflammation of the *pia mater*.

*Tubercles* are sometimes seen growing from the surfaces of the *pia mater*. They have been found as big as an egg, though usually they are not larger than a pea or a hazelnut; they are of a yellowish color, their shape is spherical, and they break down ultimately into a puriform fluid, forming circumscribed abscesses on the surface of the brain. Occasionally they are of a cartilaginous texture, and enclosed by a delicate vascular cyst.

*Ossification* of the *pia mater* is very uncommon. Dr. Baillie never saw an instance of it; but states that the celebrated Soemmering, who has published a German translation of his Treatise on Morbid Anatomy, with many excellent notes, has a specimen of this disease preserved in his collection. Dr. Hooper has also seen an example of it, in the form of a small bifid mass, not larger than a split pea, which grew from the internal surface of the membrane, and dipped down into the medullary substance of the cerebrum.

Fungous, bloody, and encysted tumors are sometimes found in the *pia mater*, or between it and the arachnoid. Dr. Esquirol, of Paris, once met with an encysted tumor of the *pia mater* containing fat; and similar cases have been recorded by other writers. All these diseased appearances, however, are extremely rare, and it has never occurred to me to observe them.

Diseased appearances are sometimes noticed in the *lateral ventricles*, and especially in the choroid plexus. As a consequence of inflammation, the lining membranes are sometimes very much thickened and indurated, their vessels gorged with blood, and their free surface covered with patches of lymph, of variable thickness and density. In the choroid plexus, the most common appearances are *serous cysts*, formed by a very delicate, vascular, and transparent membrane, filled with a clear, limpid fluid. I have never seen them very large, though occasionally they attain a considerable bulk. Their number is often very great. In an old man, seventy-five years of age, ten or a dozen of them were clustered upon the right choroid plexus, the largest of which scarcely equalled a common cherry. Instances are recorded in which as many as a hundred of them were seen in the same individual.



The ventricles of the brain seldom contain *hydatids* ; and there is reason to believe that the serous cysts just described are frequently mistaken for them. The two varieties which have hitherto been observed are the headless and bladder-tailed ; of the latter of which, five species have been seen by different pathologists. The vessels of the choroid plexus are sometimes greatly enlarged, tortuous, and almost varicose.

In making examinations of the brain we occasionally met with bubbles of air in the vessels of the pia mater, under circumstances which preclude the possibility of their being the result of putrefactive decomposition. I have repeatedly noticed this phenomenon in my own dissections, and cases of the kind are related by numerous writers, from Morgagni down to the present period. Whether the fluid here is the product of a process of secretion, as has been maintained by some pathologists, or whether it is caused by the introduction of the air in consequence of injury done to the vessels of the pia mater, or of its passage along the carotid artery, or jugular vein, are questions which are still unsettled. The gas generally presents itself in the form of white, pellucid globules, looking like small pearls, movable, and contrasting strikingly with the natural contents of the vessels. Cases of emphysematous tumors, supposed to have been caused by a secretion of air, have been noticed by Portal, Laennec, Gendrin, and other pathologists, in the cellular tissue beneath the arachnoid, and the surface of the brain, and in the lateral ventricles.

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### SECTION III.

#### OF THE BRAIN.

Various experiments have been instituted by pathological anatomists, with a view of ascertaining whether wounds of the brain and spinal marrow are susceptible of cicatrization ; but with so little success that the knowledge which has been thus obtained is comparatively unimportant. The cause of this is to be found chiefly in the fact that the animals, the subjects of the experiments, almost always die at an early period after the operation, from the effects of acute encephalitis, thus allowing the parts no chance for healing. If life be preserved for a few days, the edges of the wound are found to be greatly injected with blood, of a deep rose color, and considerably augmented in density, the induration often extending to the distance of three or four lines into the surrounding tissue. With these changes is usually seen a small quantity of soft, reddish lymph, which is smeared over the incised parts, and serves as the basis of the future granulations, which always spring up, if the animal survive the operation a week or fortnight. Not unfrequently, the cerebral tissue, instead of growing hard and firm, acquires an unusual degree of softness, from the infiltration of serosity, pus, or blood, or from the influence of all these fluids united. In other cases, these two characters are combined, the edges of the lesion being dense and indurated, whilst the parts immediately around them are soft, boggy, and permeated with liquids.

Appearances of scars, sometimes of very large size, are not unfrequently discovered in the brain after death, for which physicians have found it extremely difficult to account ; that they are formed, however, by the same sort of mechanism as in the other textures of the body, is by no means improbable. Thus, when, for example, the cerebral substance is lacerated by an effusion of blood, the fluid, as will subsequently be shown, occasionally becomes organized

and incased in a distinct cyst, which either remains during the life of the individual; or, as is more generally the case, perhaps, when the extravasation is not very copious, it is acted upon by the absorbents, by whose influence it is gradually destroyed, or reduced to a dense, fibrous texture. When this has been accomplished, there is generally to be found a true linear cicatrix, of a light citron color, and much harder than the cerebral substance, although softer than the scars which we find in most of the other tissues. These cicatrices have, in the majority of cases, a laminated arrangement, with a thickness from the third of a line to the eighth of an inch or more. Yet, not unfrequently, they are perfectly cellular, moist, vascular, and filled with serous fluid.

The brain is subject to various forms of disease, amongst which acute and chronic inflammation, suppuration, softening, ulceration, sanguineous effusions, and new growths, are the most common and important.

*Encephalitis*, cerebritis, or inflammation of the brain, seldom exists as a primary, idiopathic, or uncomplicated affection: most commonly it is the result of previous disease, as fevers, especially such as are of an eruptive nature, apoplectic effusions, tumors, and external injury. When produced by violence inflicted on the scalp and cranial bones, the inflammation is generally limited in extent, although intense in degree. Never does it involve the whole organ at once; for such a condition would, it is reasonable to infer, be incompatible with the continuance of life. The disease may occur at all ages, and in all parts of the encephalic mass, though some are more obnoxious to it than others.

The anatomical characters of the inflamed structure vary according to the duration and intensity of the disease. At first, there is merely a slight increase of vascularity, with a reddish rose-colored state of the cerebral substance. When sliced with a sharp knife, it presents a multitude of small red points, which give the section the appearance as if it were strewed with particles of vermilion. The capillaries are every where greatly injected; and so firmly is the blood crowded into them, that it is with difficulty removed by ablation. Not unfrequently small ecchymoses are met with, caused by a rupture, no doubt, of minute vessels, in consequence of the violence of the inflammatory action. The extravasation oftentimes occurs in distinct spots, but occasionally it presents itself in irregular lines or streaks, which, when numerous, give the cerebral substance a singularly mottled aspect, with various tints of red, the color being usually more florid in the cortical than in the fibrous texture.

At this early period of the inflammation, there seems to be no distinct line of demarcation between the sound and diseased parts: in most cases they run insensibly into each other, the redness gradually declining in intensity as we proceed from the centre of the irritation towards the periphery; and, although the affected structure is less tenacious than in the healthy state of the brain, it is firmer than usual, from the turgescence, apparently, of its vessels.

As the disease advances, the vascular injection becomes more and more strongly marked, and the reddish color which was displayed in the earlier stage, gradually deepens, until it acquires a brownish, claret, purple, and occasionally even a greenish or dusky yellowish shade. With this augmented capillary turgescence, amounting almost to complete obstruction, the part becomes preternaturally soft, and assumes that peculiar alteration of character, which has been described by Rostan, Lallemand, and other pathologists, under the name of cerebral mollescence.

The substance of the brain, when thus affected, has entirely lost its natural properties: it has a humid, macerated appearance, from the infiltration of serosity, purulent matter, or blood, and is often converted into a soft, greyish

pulp, bounded by a hard, vascular border, exhibiting all the signs of the first stage of inflammation. Several such disorganized spots are sometimes met with, either in close proximity, or separated by considerable intervals. When the affected structure is pervaded by numerous globules of pus, it is very apt to have a citron hue, and then constitutes what Andral has termed the *yellow softening* of the brain; from which the *red softening*, another variety which he has proposed, differs only in being of a deeper color, the broken down pulp varying from a florid to a claret tint, with intermediate shades of violet, brown, chestnut, or cineritious.

The different appearances now described are not unfrequently met with in the same diseased portion. Thus, we may have the reddened, indurated state at the circumference; next, that of serous infiltration; and, finally, that of purulent softening in the centre. The pus always occurs here, as elsewhere, at first in disseminated globules, and afterwards, if the patient survive long enough, in distinct foci. The red and yellow softening are frequently combined, one portion of the inflamed structure presenting the bloody, the other the purulent infiltration.

It has been already stated that the affected part, in the early stage of encephalitis, is, in the generality of cases, somewhat harder than it is in the normal condition. The degree of consistence is subject to remarkable variations, running through all the intermediate grades, from an indurated, firm, and elastic body to one of almost perfect fluidity. The softened mass, in such cases, is generally surrounded by the hardened, which itself is intimately, and, for the most part, insensibly blended with the healthy cerebral tissue.

In the early stages of encephalitis, as was before intimated, the red color of the inflamed part cannot be removed by ablution, nor can the engorged vessels be filled with minute injecting matter, — thus presenting a striking analogy with what takes place under similar circumstances in the serous and mucous membranes, as well as in the liver, spleen, and kidney.

The vascular and serous envelopes of the brain, are not unfrequently affected in this disease. When the cerebritis is located superficially, the inflamed portions always adhere to these tunics with unnatural firmness, especially in the early stages of the complaint; and hence, in attempting to peel them off, fragments of cerebral substance, traversed by red and distended capillaries, generally follow. The vessels of the pia mater, under these circumstances, are commonly much engorged; the arachnoid is opaque and adherent; and the intergyral hollows are filled with sero-albuminous matter, with blood, or even with pus.

From this rapid sketch of the anatomical characters of acute cerebritis, it will be perceived, that the first effects of the disease consist simply in capillary engorgement, in punctuated or striated redness, which is usually more conspicuous in the cortical than in the fibrous texture, and in increased hardness, varying in degree according to the intensity of the disorder; and, secondly, that if the inflammation be allowed to go on unrestrained, it finally passes into mollescence, in which purulent, bloody, and cerebral matter, are in general intimately blended together, forming a mass of a semi-liquid consistence, and of a light brownish color, with various shades of yellowish, greyish, claret, or even greenish.

Although all parts of the brain are liable to acute cerebritis, yet there are some which are much more frequently affected than others. The most common seat seems to be the cineritious texture, the great vascularity of which strongly predisposes it to inflammation and its consequences. Thus, of forty-six cases of this disease, collected by Lallemand, the grey substance was the principal seat of the inflammation in thirty-three, and the white in only eight. The



surface of the convolutions, which consist entirely of cortical matter, was affected in sixteen cases; the striated bodies and optic couches, in which the same substance predominates, in thirteen; and the Varolian bridge, which is made up chiefly of fibrous matter, only in four. Some influence must, also, no doubt, be allowed to the greater extent of surface of the grey substance, and to its intimate connection with the pia mater, which can seldom be much inflamed without the disease being propagated to the contiguous parts of the brain.

Acute encephalitis usually reaches its full height within three or four days from its invasion. When partial, the patient often recovers; but should it occupy a large extent of surface, it generally proves fatal in a very short time, not unfrequently, indeed, in thirty-six or forty-eight hours. The early symptoms are violent headache, intolerance of light, delirium, and acuteness of all the senses, rapidly followed by convulsions, contractions of the limbs, profound coma, and death.

Several writers have attempted to account for the various phenomena which arise during the existence of cerebritis, by a reference to lesions of particular parts of the encephalic mass. Thus, Martinet supposes\* that affections of the superior extremity are attributable to disease of the posterior fibres of the optic thalamus of the opposite side of the brain; those of the inferior extremity to alterations of the anterior half of the striated body. Paralysis of both sides of the body, existing at the same time, depends upon disease of the central part of the Varolian bridge; loss of speech, on the anterior lobes of the cerebrum; deep and progressive coma, with entire absence of palsy and muscular rigidity, upon the great commissure, fornix, or interventricular septum. When the quadrigeminal tubercles of one side are inflamed, there will be squinting and rolling of the eye, with dilatation and immobility of the pupil of the other; if, on the contrary, the disease affect both sides at the same time, the phenomena will usually be present in both eyes.

Lesions of the pituitary gland, and cineritious tubercle at the base of the brain, by causing compression of the optic nerve of one side behind the point of decussation, may induce blindness of the opposite eye; whilst derangement of the respiratory, circulatory, and genital organs, without paralysis of the extremities, indicates inflammation or other disease of one or both of the lobes of the cerebellum. Lesion of the crura cerebri is followed by the same paralytic symptoms as that of the optic thalamus and striated body, which are prolonged from it. Disease of the medulla oblongata produces all the phenomena which arise from the joint affection of the cerebellum and cerebral crura; and, if we ascend still higher in the brain, from that also of the striated bodies, optic thalami, and cerebral hemispheres.†

Inflammation of the brain not unfrequently passes into *suppuration*, the matter occurring either in the form of small yellowish globules, or in that of abscesses. The most common seat of the disease is in the anterior half of the cerebral hemispheres, on a level with the great commissure: no portion, however, of the cerebro-spinal axis appears to be exempt from it, cases of it being mentioned by various writers as having been found in the cerebellum, posterior lobes of the cerebrum, spinal cord, medulla oblongata, Varolian bridge, and even the quadrigeminal tubercles and pineal gland.

Collections of purulent fluid present themselves under several varieties of form. In one, which may be denominated the *undefined abscess*, the matter is contained in a cavity, the walls of which are formed by the surrounding brain,

\* Manual of Pathology, p. 139.

† Foville, in Dict. de Méd. et de Chir. Pratique, art. *Encéphale*.

and partly, perhaps, by its membranes, if it be seated superficially or near the ventricles. The inner surface of the abscess, though occasionally smooth and even, is generally rough, granulated, and shaggy, the purulent fluid adhering to it with various degrees of tenacity. The cerebral tissue immediately around the cavity is usually remarkably sound; seldom is there any sign of inflammation, induration, or softening. The size of these collections is variable. Not unfrequently, they are as large as a walnut; but, for the most part, they do not exceed the volume of a pea, a grape, or an almond. Occasionally, almost the whole hemisphere is converted into a soft, purulent mass.

The second variety of abscess is the *encysted*. The pus in this species, as the name indicates, is contained in a distinct capsule, formed by the deposition of plastic lymph. The capsule, at first, is soft, delicate, and easily torn: in time it becomes dense, remarkably firm, and completely organized,—vessels in great numbers ramifying through it from the circumjacent cerebral tissue. The outer surface of the sac at this stage is rough and flocculent; the internal is smooth, of a rose color, and somewhat villous, like the mucous coat of the stomach. Its thickness rarely exceeds that of the pericardium; but instances occasionally occur in which it is from a fourth to a half of an inch. In cases of very long standing, the cyst is often very firm and indurated, from its conversion into fibrous, cartilaginous, or osseous texture. Under such circumstances, it is not unusual to find it composed of several folds, intimately connected with each other, but differing remarkably in their color, density and thickness, the softest being generally internal, as if they had been secreted by the others. Cases, again, occur, in which the cyst is divided into numerous cells, formed by hard, greyish, intersecting bands.\*

The object of these cysts evidently is, to serve as barriers to the extension of the pus which they enclose. Rudiments of them are occasionally found as early as the end of the first week; and, according to Lallemand and Rostan, it is not uncommon to find them perfectly organized at the expiration of a month. Patients thus affected, not unfrequently live for a long time before the brain is so far destroyed as to render the continuance of life impossible. Professor Horner mentions an instance in which the interval between the infliction of the injury—a pistol wound—and the fatal termination was nearly twelve months; Sir Everard Home, one of nineteen months; and Dr. Copland, one of upwards of three years. Similar cases are to be found in the writings of Sir Astley Cooper, Hennen, and other surgeons. When the cyst finally becomes the cause of death, it is by exciting fresh inflammation in the surrounding cerebral texture; or it may, acting in the capacity of a foreign body, excite inflammation in the arachnoid membrane, and destroy life by the consequent effusions.

Abscesses of the brain, however, do not always terminate fatally, for numerous cases occur in which there is every reason to believe that the pus is absorbed, and the cavity of the cyst gradually obliterated by the approximation of its walls. The opinion, at all events, derives confirmation from the appearances of the large cicatrices which are so often found in the brains of old persons,

\* In Mr. Hart's case the matter was contained in a tubular cyst, which occupied the very centre of the cord, from the first to the twelfth dorsal vertebra: it was of an oblong form, a third of an inch in diameter, and so solid as not to collapse after the fluid was evacuated, its parietes being one line in thickness. A globular sac, about the size of a hazelnut, and filled with aqueous fluid, pressed on the nerves of the cauda equina of the right side, and produced the spasmodic twitchings of the muscles of the limb under which the child, nine months old, had labored during the last four or five weeks of its life. The head was enlarged, and a considerable quantity of straw colored serosity existed on the surface of the brain, in the ventricles, and in the spinal canal. (Dublin Hospital Reports, vol. v., p. 522.)

and from the intersecting bands which are occasionally seen uniting the sides of encysted abscesses.

In respect to its appearance, the pus found in the brain differs in no essential particular from that in other parts of the body. In the generality of cases it is of a pale straw color, thick, and inodorous; not unfrequently, however, it is greenish, reddish, or dirty white, thin, and remarkable fetid: this is particularly the case in young subjects who die from the extension of inflammation of the ear to the brain. In scrofulous persons, the pus is generally very thick and tenacious, from the admixture, probably, of plastic lymph.

Suppuration of the brain sometimes takes place with great rapidity. Dr. Abercrombie saw a case in which there were several small, undefined abscesses at the end of four days: Laennec asserts that he has known pus to form in less than twenty-four hours. The purulent fluid, when unencysted, often manifests a tendency to pass from its original situation to some other. Thus, when it is seated in one of the hemispheres, it may work its way gradually to the surface, or into one of the ventricles, destroying occasionally, in the former case, the lining membranes, with the contiguous bone. In 1827, I examined the body of a stout athletic man, about forty years of age, who died nearly three weeks after the removal of an osteo-sarcomatous tumor from the nose by Professor McClellan, of Philadelphia. For the first two weeks after the operation, the patient did remarkably well, and talked of returning to his friends who lived several hundred miles off, in the State of New York. A few days, however, before he had determined on starting, he was suddenly seized with violent rigors, which were followed in a short time by deep coma, and he expired after an interval of thirty-six hours from the attack. On examination, Dr. Gardner and myself found a large, undefined abscess, filled with thick, offensive matter, on the lower surface of the right anterior lobe of the cerebrum, with partial destruction of the cribriform plate of the ethmoid bone and the intervening membrane in its immediate vicinity. Cases, in many respects similar, are narrated by Lallemand, Rostan, and other writers. The symptoms of cerebral abscess do not differ materially from those of the last stages of ordinary inflammation,

The brain is occasionally the seat of *metastatic abscesses*, but much less frequently than the lung and the liver. They do not, as in these two organs, exhibit at first the rounded, circumscribed form, but appear in small isolated points, which are extensively scattered through the cerebral tissue, and rarely, even in their worst cases, exceed the volume of a hempseed, or a small pea. Their number is sometimes immense. They are situated chiefly in the grey substance of the hemispheres and of the striated bodies: the cerebellum is also occasionally affected, but much more rarely than the cerebrum. The tissue in the immediate vicinity of the purulent collections is generally unaltered. The disease, as in other parts, is very insidious in its mode of development, and is usually dependent upon injury or lesion of some distant organ.

*Gangrene* of the cerebral tissue is a very rare affection, and probably never occurs except as the result of external violence. As an idiopathic disease, I am not sensible that a single instance of it is to be found in the writings of pathologists. In this affection, the cerebral substance is at first of a reddish brown color, but in a very short time becomes spotted with an immense number of minute greyish points, resting upon a lilac, violet, or purple ground. At a more advanced stage, when the mortification may be considered as fully established, the affected part is converted into a soft, pulpy cartilage, of a blackish, brownish, or greenish color, and extremely fetid, — a character which distinguishes this lesion from the simple softening presently to be noticed. The



cerebral texture immediately around the sphacelated mass generally forms a hard, reddish belt, highly injected, and occasionally even slightly ecchymosed from sanguineous effusions.

*Encephalomalacia*, ramollissement, mollescence, or softening of the brain, was first described as a distinct lesion, in 1820, by Dr. Leon Rostan,\* of Paris, though it had been previously noticed by Morgagni, in his work on the Seat and Causes of Diseases.† The latest and most valuable contributions that have been made to this branch of pathological anatomy are from the pen of Durand-Fardel, a French physician. His work, published at Paris in 1843, under the title of "*Traité du Ramollissement du Cerveau*," received the prize offered by the Royal Academy of Medicine, and is beyond doubt the most complete memoir of the kind extant. No inconsiderable degree of light has also been thrown upon the nature of this affection by the researches of Lallemand,‡ Gendrin,§ Herbst,|| Fuchs,¶ Cruveilhier,\*\* Abercrombie,†† Carswell,‡‡ and Sims.§§

Softening of the brain is exceedingly frequent, both as an acute and a chronic affection. It is by far most common in old subjects, but no age seems to be exempt from it, and, if we may credit the assertions of Billard, one of the most excellent writers on infantile diseases, there is reason to believe that it occasionally exists as an intra-uterine lesion. Of thirty cases of simple uncomplicated ramollissement, examined by Rostan, three occurred below the age of sixty-seven, seven between sixty and seventy, fifteen between seventy and eighty, and eight after this period of life. Of the cases reported by Dr. Fuchs, four were under seventy, and ten above that age. As a complicated disorder, softening of the cerebral tissue may, as was before intimated, take place at any period of life, but is perhaps most common between the thirtieth and fiftieth years. This, at any rate, is the result of my own observation.

There is no portion of the encephalic mass in which softening has not, at one period or another, been observed. The structures, however, which are most obnoxious to it, particularly the acute form of the disease, are the convolutions, the striated bodies, and the optic couches. Of fifty-three cases, analysed by Durand-Fardel, the seat of the morbid change was as follows:

In the convolutions and white substance	-	-	-	22 times.
„ Convolutions alone	-	-	-	6 „
„ White substance alone	-	-	-	5 „
„ Striated body and optic couch	-	-	-	6 „
„ Striated body alone	-	-	-	11 „
„ Optic couch alone	-	-	-	4 „
„ Varolian bridge	-	-	-	3 „
„ Cerebral limb	-	-	-	1 „
„ Great commissure	-	-	-	1 „
„ Interventricular septum	-	-	-	1 „
„ Fornix	-	-	-	1 „
„ Cerebellum	-	-	-	1 „

\* Recherches sur le Ramollissement du Cerveau, Paris, 1820.

† Book First, Letter 5, Art. 6.

‡ Recherches sur l'Encephale, Paris, 1824.

§ Histoire Anatomique des Inflammations, Paris, 1826.

|| De Encephalomaciâ. 4to. Halle, 1825.

¶ Beobachtungen und Bemerkungen über Gehirnerweichung. Leipzig, 1833.

\*\* Anatomie Pathologique, livraison xx.

†† Path. and Practical Researches on Diseases of the Brain. Edinburgh, 1828.

‡‡ Cyclopædia of Practical Medicine, article "Softening of Organs."

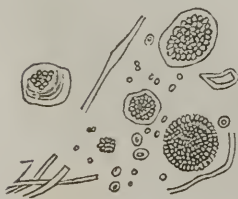
§§ London Medico-Chir. Trans., vol. xix., p. 381.

The parts of the brain which, according to my own experience, are most liable to this lesion, are such as are most obnoxious to sanguineous effusions, as the fornix, interventricular septum, great commissure, optic couches, and striated bodies; the frequency with which they are affected being in the order here enumerated. In the majority of cases I have found the figurate bodies alone implicated, the convolutions and other structures retaining their normal characters. Both cerebral substances are almost always simultaneously softened, though the white is often affected in a much greater degree than the cineritious.

The extent of the lesion varies in different cases. Occasionally large masses are involved, as one-third, one-half, or nearly the whole of one hemisphere; more generally, however, the lesion occurs in circumscribed spots, varying from several lines to one or two inches, and leaving the rest of the organ of its natural color and consistence. Sometimes the softening occupies a space not larger than a cherry, a pea, or a millet-seed. Durand-Fardel has seen almost the entire surface of both hemispheres and that of the ventricles affected; and an example not less remarkable came under my notice in 1836, in a man forty-five years old. In this case, examined twenty-seven hours after death, both the white and grey substance had lost much of their natural firmness and cohesion. The whole of the fornix, excepting its anterior pillars, the interventricular septum, part of the great commissure, and the pineal gland, were completely dissolved. The striated bodies, optic couches, and quadrigeminal tubercles, were likewise much softened; and so tender was the base of the brain, that the medulla oblongata, cerebral crura, and roots of the nerves, were all left behind in the attempt to remove the organ from the skull. In the cerebellum, the parts which were more particularly diseased, were the cerebello-testicular processes, the Vieussensian valve, and the grey substance at the under surface of each lobe. The vessels of the pia mater in this case were excessively gorged with blood; and the fibrous texture of the hemispheres, especially of the right, exhibited a considerable number of small, rose-colored patches, dappled with black points, corresponding with the orifices of divided capillaries. No lesion, so far as could be discerned, existed in any other organ, and there is every reason to believe that death was occasioned by the diseased state of the brain.

The appearance and consistence of the part affected vary according to the duration of the disease and the intensity of the exciting cause. In the early stages the changes are always very slight, and can only be recognized by the touch. At a more advanced period, the continuity of the organic particles is sensibly disturbed, and the nervous substance is so soft that it may be readily broken down with the finger into a thin, pap-like mass. It is no longer able to sustain the slightest weight, and has no more consistence, frequently, than so much cream or thickened milk: it may be easily scraped with the knife, but to cut it smoothly is impossible. Having attained this degree of softening, the cerebral tissue soon falls to pieces, forming thus a breach of continuity occasionally of very considerable extent. Fig. 103, from Bennett, represents the granules mixed with broken nerve-tubes. An odor like sulphureted hydrogen sometimes exhales from the disorganized mass; but this is very rare, and I have never met with it. According to Billard, it would seem to be more common in children than in adults.

Fig. 103.



Although the softened parts are occasionally separated from the sound by a

distinct line of demarcation, yet more commonly they run insensibly into each other. The color varies according to the time that has elapsed since the invasion. In the early stage, when there is usually a considerable degree of inflammatory turgescence, it is often of a uniform rose tint, studded with red dots, or marked with purple arborescent lines; more rarely we find small hemorrhagic effusions, and patches of a dark leaden hue, produced doubtless by intense capillary injection. At a later period of the disorganization, the part is usually of an opaque white, brownish, yellowish, or greenish color; or these tints are blended, different shades of them occurring at different points, or even at the same place. The dull milky hue, which is so frequently observed in this affection, is supposed by Lallemand to be caused by an infiltration of pus,—an opinion which is evidently unfounded, as in the vast majority of cases no such fluid whatever is to be seen. In this condition, which is often found after hydrocephalus, the cerebral mass seems to be perfectly anemic, not a drop of blood oozing from the affected part when cut. In some instances, the color remains natural. When this happens, which, however, is rather rare, the softening is usually confined to the fibrous structure, and may readily escape notice.

In this affection, the pia mater is sometimes seriously implicated. When the softening is seated on the convoluted surface of the cerebrum or cerebellum, or on the surface of the striated bodies and optic couches, the membrane is generally preternaturally red and rough, and, on attempting to raise it, the disorganized grey substance often separates along with it. In other cases, I have found portions of the pia mater completely destroyed, or converted into a dirty brownish pulp, void of every feature of the original texture. These changes are particularly liable to happen when the softening affects the surface of the figurate bodies in the floor of the lateral ventricles. In these cases the arachnoid frequently experiences the same fate.

Chronic softening of the brain is probably quite as frequent as the acute form of the disease, of which it may be either the consequence, or it may exist as an original and independent affection. It may occur at any period of life, and all parts of the organ appear to be liable to it, though not in an equal degree. It may be limited to the white or cineritious substance, to a single convolution, to the striated body, or to the optic couch. Occasionally it is diffused throughout the different cerebral structures, not uniformly, but in patches of variable extent. The most common seat of the lesion appears to be the hemisphere, including the striated body and optic couch. In ninety-five cases examined by Durand-Fardel, the anterior lobe was affected in thirteen, the middle in fifty-one, and the posterior in eighteen; the posterior and middle lobe in seven, the posterior and anterior in two, and the middle and anterior in two; the middle line in one, and the whole convexity of one hemisphere in one. Chronic softening occurs less frequently on the surface of the brain than in the figurate bodies, differing in this respect somewhat, though not much, from the acute form of the disease.

The color of the softened part varies according to the nature of the cerebral tissue. In the fibrous substance it is always milk-white, dull-white, opalescent, or of a pale yellow; never red, brownish, or brown-red, as in the acute form of the lesion. There is a total absence of congestion, and in many cases there is hardly even a vestige of capillary vessels. Occasionally, though very rarely, a few long, slender, arterial and venous twigs are observed, but the interlacement which they exhibit is very different from the normal capillary plexus. In the cortical substance the color usually partakes more or less of the natural complexion of that tissue, that is, it is either a light



grey, or a pale ash. This is particularly the case in the early stages of the disease. At a more advanced period, the affected part gradually loses its greyish color, and assumes a yellowish, or pale dusky aspect. This discoloration may be greater at one point than at another, but in the majority of cases it is pretty uniformly diffused over the seat of the disease.

In the chronic, as in the acute form of the disease, the degree of softening may vary from a slight diminution of the natural cohesion of the cerebral substance to that of a thin solution of starch, or arrow-root, cream, or even milk. In the advanced stage of the disease, when the process is fully established, the affected structure is infiltrated with an unusual quantity of serosity, and reduced to a semi-fluid pulp, which is easily removed by the finger, the handle of a scalpel, or by a small stream of water. These changes, which are generally more conspicuous in the white than in the grey tissue, are frequently followed by the removal of the softened and disorganized matter, leaving in its place a small quantity of cellular substance, of a whitish aspect, traversed by bloodvessels, and exhibiting numerous meshes, filled with a turbid, whey-like fluid. The meshes are of an irregular form, and vary in size from a pin-head to that of a small pea; their walls are extremely delicate, and the fluid by which they are occupied is often mixed with flocculi, which appear to be nothing more than fragments of cerebral pulp. When the patient survives an attack of this kind, the cells thus formed are filled with plastic matter, which becomes speedily organized, and gradually increases in firmness until it finally acquires all the properties of the cellulo-fibrous, fibrous, or fibro-cartilaginous tissue. In no case does there appear to be a reproduction of cerebral matter.

In the grey substance, in the advanced stage of the disease, there is a singular tendency to the production of yellow patches, of a flattened form, finely tuberculated, and extending, when the lesion occupies the superficial portion of the brain, over two or more convolutions. They are remarkably coherent, their surface is traversed by minute vessels, and their consistence may be so great that they are with difficulty torn. In some instances they are surrounded by pulpy matter, and in others, though this is very rare, the cortical substance seems to be destroyed by ulcerative absorption.\*

The duration of chronic softening of the brain is too uncertain to enable us to affix any precise limits to it. While some cases terminate in three or four weeks, others continue for several months, or even years; the disease in the mean time making very little progress, or even remaining perfectly quiescent. Andral states that out of one hundred and five persons affected with ramollissement, upwards of sixteen survived the first month, more than ten the second month, seven reached the end of the third month, and two lived for three years.

Concerning the origin and intimate character of cerebral mollescence, authors have expressed different sentiments. Recamier views it in the light of a peculiar disease, as the effect of a morbid nutrition of the part, not unlike certain alterations of the spleen, resulting from a disordered state of the whole system, the force of which is spent mainly upon the encephalic mass. This notion derives plausibility, at least in some degree, from certain circumstances to which I shall have occasion presently to advert. Rostan, who has written an able and elaborate treatise on this affection, considers it as a mode of disorganization very similar, in its essential features, to senile gangrene. Admitting that it may sometimes be an effect of inflammation, he seems to look upon it as a peculiar and primary lesion, the precise nature of which he confesses

\* Durand-Fardel, *op. cit.*

himself unable to explain. It is worthy of note, that most of the cases observed by this distinguished pathologist occurred in persons between seventy and eighty years of age, and that the disorganization, seated chiefly in the external parts of the brain, was often connected with sanguineous effusions, or old apoplectic cysts. From the appearances exhibited on dissection, he was led to infer that the lesion, instead of being the product of inflammatory action, is dependent upon ossification of the cerebral arteries, though it is a singular fact, that no mention is made of the actual presence of this degeneration of the vessels of this organ in any of his autopsies. Dr. Abercrombie, in the first edition of his work on the Diseases of the Brain, advocated the doctrine of the inflammatory origin of softening; more extended observation, however, has induced him to modify his views, and he now regards this affection as analogous to gangrene in other parts of the body, which may arise here as elsewhere from various causes acting injuriously on the local vitality and organization. "The two principal of these causes are inflammation of the cerebral substance, and the obstruction of the circulation from obliteration of the cerebral vessels." The former he conceives to have been the origin of the cases described by himself, as occurring in young and middle-aged subjects, in the central parts of the brain, as the fornix, great commissure, and inter-ventricular septum; the latter as giving rise to the lesion in the superficial structures, in persons far advanced in life, who, as is well known, are extremely prone to ossification of the arteries. Lallemand contends that softening is a constant and necessary result of an acute, subacute, or chronic inflammatory irritation of the part. Nevertheless, he asserts that he has occasionally met with cases of mollescence in which the symptoms have followed so slow and gradual a course, and, withal, have exhibited such a degree of mildness, as almost to preclude the idea of such a process having been in operation. Dr. Durand-Fardel, who has examined this disease with great care, both as it respects the morbid appearances and the symptoms which attend it during life, concludes that it is invariably dependent upon inflammation; which, while it has nothing special in its nature, is essentially the same in the young and the old, and whether the lesion is produced by local injury, or developed spontaneously, and without any assignable cause. In the acute stage, there is generally more or less redness, while in the chronic form there is usually an entire absence of this variety of discoloration, the affected part being of a white, milky, or yellowish complexion.

In the first edition of this work, I expressed the opinion that softening of the cerebral tissue is always of inflammatory origin, and further observation has only contributed to confirm this belief. Indeed, I cannot see how it is possible to arrive at any other conclusion, especially if we take into consideration the important fact that this lesion occurs at all periods of life, as well as in all parts of the encephalic mass, at one time as an acute, and at another as a chronic affection; that it is often produced by external injury, and by the pressure of certain tumors, or apoplectic effusions; that it is frequently combined with suppuration in other parts of the brain; and, finally, that it occasionally supervenes during the progress of malignant and other fevers. That ossification of the arteries, and a consequent interruption to the passage of the blood, followed by diminished vital power and cohesion of the part affected, may operate as an exciting cause of the malady in old subjects, is what may be easily supposed; but I am by no means certain that in cases even of this description, there must of necessity be an absence of inflammatory irritation. Gangrene under such circumstances is usually, if not invariably, a gradual process, preceded and accompanied by perverted, if not incited, action.

Softening of the brain is often found in connection with ascites, pulmonary phthisis, diabetes, chronic pleuritis, marasmus, and protracted fevers. Grief, anxiety, and intense study, sometimes produce it. This was the appearance which the brain of Sir Walter Scott exhibited. The mollescence involved nearly the whole of the medullary texture of the left hemisphere, which was converted into a soft, flaccid mass, interspersed with numerous globules of water. This mischief was the result, in all probability, of a slow, chronic irritation, produced by the excessive intellectual labor to which this great man subjected himself during the last five or six years of his existence, in consequence of his pecuniary embarrassments.

Protracted confinement, with inactivity and low diet, also, have a tendency, it would seem, to impair the natural consistence of this organ. This circumstance has been remarked by different observers, and is particularly dwelled upon by Dr. Munro, in his treatise on the Morbid Anatomy of the Human Brain. Similar appearances have been witnessed in the cerebral tissue of idiots, lunatics, and epileptics. In an elaborate account of the anatomical changes found in the brains of maniacs and epileptic persons, published, in 1771, by Dr. Greding, a German physician, fifty-one cases are detailed, in more than one-half of which the organ in question was either partially or generally softened. Observations confirmatory of these have since been recorded by other writers. How softening, under the circumstances here specified, is induced, whether from diminished nutrition of the cerebral texture, or from irritative action, giving rise to an infiltration of serous fluid into its intermolecular spaces, is a point which challenges further researches. Old age, also, seems to predispose to this affection; and the same may be said of arteritis and ossification of the vessels.

As yet no pathologist has succeeded in pointing out any symptom or group of phenomena by which this disease can be distinguished from other encephalic affections. It has been supposed by some, that the rigid contraction of the limbs, so often witnessed in patients who are laboring under this lesion, afforded a characteristic sign; but the fact that individuals often die in whom the extremities are completely relaxed, is sufficient evidence of the fallacy of the opinion.

The duration of acute softening varies from forty-eight hours to a month, the great majority of cases terminating fatally between the fourth and ninth day. From the observations of Lallemand, it would appear that nearly one-half die within the first seven days from the attack; about two-fifths at the end of the second week; and the remainder at intervals of one, two, or three months. Of fifty-nine cases of acute softening, examined by Durand-Fardel, eleven terminated fatally within the first forty-eight hours, twenty-six before the fifth day, forty-three before the ninth day, seven from the ninth to the twentieth day, and nine from the twentieth to the thirtieth day.

An interesting circumstance in relation to this disease is the fact of its occurring, not unfrequently, in the horse and other animals, both in the brain and spinal cord. The consistence and appearance of the altered texture are the same precisely as in the human subject. Professor Dupuy, of Paris, by whom this fact was first ascertained, states, that the principal symptoms are, trembling of the limbs, general debility, and convulsive movements of the muscles, with tetanic stiffness of the neck, lower-jaw, or extremities, especially the hinder.

Does mollescence of the brain ever get well? This is an interesting and, practically speaking, a highly important question. As is usual in all such matters, a great contrariety of sentiment prevails among pathologists, which is the more surprising, since, upon whatever can be determined by direct obser-



tion, there should always be but one opinion. Professor Andral, who has bestowed a good deal of attention upon the subject, doubts whether it is possible for a cure ever to be effected, especially if the softening have been fully established. In this view he is sustained by several of his countrymen; whilst opposed to it is the high authority of Cruveilhier, one of the most eminent writers of the present period. "The cicatrization," says he, "of the grey substance is marked by the development of small cavities with a dense, yellowish scar; of the white, by the formation of minute cells, filled with a clear, gelatinous fluid, like thin size." Confirmatory of all this, it is asserted by the late Dr. John Sims, of England, that the cure of cerebral mollescence is not only possible, but very frequent. In twelve cases of this disease, occurring in old sexagenarian patients, he noticed all the characteristic marks of cicatrization, in different stages of its progress. When fully accomplished, the traces of the cure in the grey substance are a peculiar cribriform aspect of the convoluted surface of the brain, either alone, or combined with atrophy and flattening, and adhesion of the pia mater to the affected part. In the white substance, cicatrization is indicated by numerous little holes, containing a limpid fluid, and lined occasionally by a fine, delicate, transparent membrane, of a light fawn-color. These cells have sometimes a worm-eaten appearance, and not unfrequently they seem as if they had been scooped out with a sharp instrument. In their size they vary from a pin-head to the volume of a bean; and, in their figure, they strongly resemble the pores observable in new bread. The cerebral tissue in the immediate neighborhood of these cicatrices is either of the natural consistence, slightly softened, or, as is more frequently the case, considerably indurated, according to the period that has elapsed since the commencement of the healing process. Occasionally the white matter has a peculiar granular aspect.

Such is the opinion of Dr. Sims, concerning the cure of mollescence of the grey and white substance of the brain. As regards myself, my observations have been too limited to enable me to speak with that confidence which should ever characterize the statements of the pathological anatomist. Without doubting the accuracy of the investigations of this gentleman, or calling in question the candor of his assertions, I am forced to reject his opinion, that cicatrization is a very frequent occurrence in this affection. At the same time I am far from agreeing with Andral and others, that it can never happen. That it does sometimes take place, is sufficiently proved by the phenomena observable in the mollescence which occurs around apoplectic effusions, and in the neighborhood of morbid growths. The subject, however, requires further elucidation, and, until this be had, no theory, however plausible or ingenious, will be deserving of much confidence.

*Chronic inflammation* of the cerebral tissue is much more common than acute, of which, indeed, it is not unfrequently the result. Its anatomical characters, though occasionally similar, are yet, in the great majority of cases, widely different; and it is therefore necessary that they should be considered under a distinct head.

The most important feature of this disease, and one which may be considered as strictly characteristic, is the augmentation of density of the affected tissue, giving rise to that alteration of substance which has been designated, within the last twelve or fifteen years, by the term *induration*. Not a little diversity is observable in regard to the degree of hardening.

In the generality of cases, the consistence does not exceed that of concrete albumen; not unfrequently, however, the part is as firm as cheese; and instances occur, although very rarely, in which it is as dense and elastic as fibro-

cartilage. The latter species of induration is generally seen in small, insulated masses around old apoplectic cysts, tubercles, and fungous growths. The other two, which often occupy a considerable extent of surface, sometimes co-exist, running insensibly into each other. General induration has hitherto been seen chiefly in individuals that have died of typhous fever; and Andral tells us that he also witnessed it several times in persons who had been in the habit of working among lead, and who expired in a state of universal convulsion.

The proximate cause of cerebral induration is unquestionably a deposition of lymph into the connecting cellular tissue, by which the intermolecular intervals are filled up, and the fibres of the brain firmly cemented together. That this is the case, is not only analogically inferrible, but may be readily proved by examination with the microscope. A portion of brain thus affected possesses little or no moisture, recoils with elasticity when stretched, and tears with a rough and slightly granulated surface. The natural vascularity is usually very much diminished, probably from an obliteration of some of the capillary vessels; and hence the ordinary color is yellowish white, milky, or greyish, — seldom reddish, brown, or claret, as we find it to be in acute softening of the cerebral tissue.

Chronic cerebritis, after having existed for some time, may suddenly assume an acute character, and thence pass into suppuration. A shade of green usually announces this event; and, as the process advances, the part gradually acquires a yellow tinge, and a soft, pulpy consistence. The pus is rarely confined in a distinct cavity; on the contrary, it is usually diffused through the softened mass, oozing out of it, when a section is made, in the form of small globules.

The progress of chronic cerebritis is generally very tardy, especially when it is limited in extent; and I am not aware that any symptoms have yet been pointed out as diagnostic of its presence.

From the several forms of inflammation, abscess, and softening, which have now been described, the transition to *ulceration* is at once easy and natural. This state of the brain, although of very infrequent occurrence, has been noticed by different observers, among whom it will suffice to mention Morgagni, Portal, Howship, Anderson, Scoutetten, Powell, and Andral. It has been found, hitherto, chiefly on the striated bodies, the optic couches, and on the convoluted surface of the cerebrum, in the latter of which situations it is by far most commonly met with.

The ulcers, which seldom penetrate beyond the grey substance, and which affect various forms, have generally rough, indented edges, with an irregular surface, covered, for the most part, with reddened lymph, in some cases with pus, and occasionally even with blood. Instances occur in which they are hard and dry; and sometimes, though rarely, they communicate together by fistulous tracks, in the same manner as ulcers occasionally do in other parts of the body. In their dimensions they vary from a few lines to several inches, the largest being almost always seated on the external surface of the brain. In a man, twenty-four years of age, who died with all the symptoms of cerebral irritation, complicated with enteritis, Scoutetten found an ulcer, of a pale citron color, on the anterior lobe of one of the hemispheres, thirteen lines long, and seven broad, with a hard, dry surface, and edges singularly indented. The subjacent cerebral matter was perfectly sound, as was all the rest of the brain; but the arachnoid tunic was throughout deeply injected, and the part of it corresponding to the erosion destroyed. In a case recorded by Dr. Anderson, an English physician, the ulcer was two inches and a half long,

one and a half broad, and nearly one in depth. It was situated on the upper part of the right hemisphere, and contained several thin, brownish lamellæ, filled with soft sabulous concretions, so brittle as to break upon the slightest touch.

The cerebral tissue immediately contiguous to these ulcers usually exhibits signs of inflammation, being of an unnaturally red color, and of varying degrees of consistence. The pia mater and arachnoid are also more or less affected, — a circumstance from which some pathologists have been led to infer that these ulcers rather appertain to them than to the cerebral substance. This, perhaps, with a few exceptions, is true. Occasionally, the ulcer communicates with deep-seated abscesses.

Ulceration of the brain is indicated by headache, partial convulsions, hemiplegy, loss of memory, hebetude, coma, and progressive debility, complicated, not unfrequently, with gastro-enteric irritation.

There are few diseases, a knowledge of which is of more interest to the pathologist, or of greater importance to the practical physician, than that of *cerebral apoplexy*. Occurring at all periods of life, as well as in all parts of the encephalon, it frequently gives rise to the most serious lesions, and demands measures of the most prompt and energetic character. Hence, as might have been anticipated, the lesion has always been an object of the deepest anxiety with the practitioner, and has elicited from time to time the researches of some of the ablest men of the profession. It is only within the last twelve or fifteen years, however, that any real and substantial light has been thrown upon its anatomical characters, its causes, and the nature of its symptoms.

The term apoplexy is of Greek derivation, and literally signifies a stroke or blow. The lesion which it serves to designate, and which invariably depends upon sanguineous effusion, exhibits a remarkable variety as to its seat and extent. In many cases, the blood is poured into the substance of the brain; in some, upon the external surface; and in some, again, into the ventricles. Of these three forms, the last is by far the least frequent; next to this is the meningeal, or that in which the fluid is extravasated upon the surface of the brain; and the most common of all, is where it is diffused through the cerebral tissue. It has also been found that certain parts of the encephalic mass are more liable to hemorrhage than others. Of three hundred and ninety-two cases of this disease, collected by Andral from the writings of different pathologists, two hundred and two affected the interior of the cerebral hemispheres on a level with the floor of the lateral ventricles; in sixty-one, it was seated in the striated bodies, and in thirty-five, in the optic couches. The cerebellum is rarely affected, and the same is true in regard to the rest of the cerebrum. Of the reason of this greater liability of some portions of the encephalic mass to sanguineous effusions than others, we are still ignorant.

In regard to the extent of these extravasations, the greatest possible variety obtains. Often the quantity is very trifling, not exceeding a few drops, or the volume of an ordinary pea; sometimes, however, the effusion is quite copious. In one instance, in a female fifty-six years of age, I found it amounting to nearly eight ounces; and still more remarkable examples are recorded by authors. The number of extravasations is also liable to much variation. Very frequently, there is only a solitary one, whilst at other times there are as many as ten or a dozen. When numerous, the sanguineous dépôts usually exhibit different appearances, as if they had occurred at different periods.

The appearance of the extravasated blood varies, as has just been intimated, according to the length of time that has elapsed between the attack and the death of the patient. When the apoplexy proves suddenly fatal, the fluid is



dark colored, almost fluid, or in soft, semi-liquid masses. If the individual survive for a longer period, the clot acquires a greater degree of consistence, and is of a pale red, greyish, or yellowish tint. At a still more advanced stage, it becomes hard, dense, and fibrinous, and is either organized, partially or entirely absorbed, or converted into a loose, drab-colored cellular substance, presenting, when cut, a peculiar appearance, not unlike that of a honeycomb. These changes usually begin within the first fortnight after the attack, and are completed at the expiration of several months, the length of time being always greater in proportion to the size of the clot. Riobe found blood in an apoplectic cavity after twenty months; Serres at the end of several years.

The substance of the brain around the extravasated blood often presents important lesions, consisting chiefly in a change of color and consistence. Very frequently, it is softened, lacerated and infiltrated with serosity, with blood, or even with puriform matter, or perhaps all these fluids are found in intimate combination. The color, in such cases, is either natural, reddish, yellowish, or greenish, according to the degree of capillary injection, or the amount of inflammatory irritation. In some instances, we find the apoplectic cavity intersected with shreds of cerebral substance, so incorporated with the extravasated fluid as to be no longer distinguishable from it. In chronic cases, the surrounding parts are more commonly indurated and brittle; but this occurrence is by no means constant.

The effused blood is often surrounded by a distinct cyst, formed by plastic lymph, from the fourth of a line to the eighth of an inch in thickness. At first, the sac is quite soft; but it gradually increases in consistence, and is finally completely organized, its parietes being abundantly supplied with vessels, which not unfrequently extend even into the enclosed clot itself. Its external surface is generally flocculent, and the cerebral tissue immediately around it is variously altered, being either softened, infiltrated with pus, or indurated. In time, the sac becomes both an absorbing and a secreting texture, as is evinced by the fact, that its interior is often filled with substances quite different from those that were deposited in the first instance; and also by the circumstance, that it is sometimes completely cicatrized, its walls being brought so closely together as to leave merely a hard, fibrous ridge or band.

The number of apoplectic cysts usually corresponds with the number of sanguineous effusions which have at different times taken place; and hence several of them are occasionally seen in different parts of the same brain. In examining, not long ago, an old man who died of softening of the brain, produced by the irritation of a large clot of blood, I found as many as a dozen of such sacs scattered through various portions of the cerebral hemispheres, the biggest of which scarcely equalled a hazelnut: they were of a yellowish color, of the consistence of cellular tissue, and marked off each into several little cavities, filled with a thin, turbid serosity.

All these facts are extremely interesting, as showing how much may be effected by the restorative powers of the system. No sooner has the effusion taken place, than nature sets up a process of reparation, in which she is often so successful, that in the course of a short time the clot is either absorbed, encysted, or so altered in its physical and vital properties as to be no longer viewed by the organ in the light of a foreign body. There are several circumstances which favor the absorption of the coagulum, but none so powerfully as a healthy condition of the cerebral circulation. This fact, as the reflecting reader will perceive, is one of great practical moment, as it imperiously inculcates the importance of paying attention to the head, long after the apoplectic seizure has taken place.

Concerning the *sources* of these sanguineous effusions, little need be said in this place. From the researches of Dr. Serres, a recent French writer, it appears that the blood may, in some instances, proceed from the minute vessels of the brain without rupture, constituting that variety of the disease to which some pathologists have applied the term *meningeal apoplexy*. The fluid, in such cases, escapes from the pia mater into the intergyral hollows, or into the ventricular chambers, or, finally, into the substance of the brain, which itself remains sound. When blood is found in the cerebral cavities, it may be concluded that it has proceeded from the source just mentioned, or from rupture of the vessels of the choroid, or from a communication with an apoplectic cavity in one of the hemispheres.

The hemorrhage, however, most usually results from rupture of the vessels, caused by a diseased condition of their tunics, and a consequent inability to withstand the shock of the circulating fluids. In several instances I have satisfactorily traced the effusion to this source. Occasionally, the lesion is associated with aneurismal tumors,\* laceration of the cerebral sinuses, or ossification of the meninges. In infants it is sometimes induced by the pressure which is exerted upon the head during parturition. The blood, in such cases, is usually poured upon the surface of the brain and spinal cord, in the form of a layer, of variable thickness and extent.

Apoplexy has been observed at all periods of life. Billard has recorded an instance which took place in an infant soon after birth; Serres relates one which occurred in a child of three months; Stokes, Guersent, Greenhow and Andral, have also met with cases at a very tender age. Nevertheless, the lesion is much more common in the old than in the young. Dr. Rochoux,† in an able essay on this disease, has shown that the most obnoxious period decidedly is between the sixtieth and seventieth years. In sixty-nine cases noticed by this distinguished pathologist, two occurred between the twentieth and thirtieth years; ten between the thirtieth and fortieth; seven between the fortieth and fiftieth; thirteen between the fiftieth and sixtieth; twenty-four between the sixtieth and seventieth; twelve between the seventieth and eightieth; and one between the eightieth and ninetieth. Similar observations have been made by Lerminier, Serres, and other authors.

But this is not the only cause which operates in the production of apoplexy in old subjects. The nervous pulp, in advanced life, frequently undergoes a remarkable degree of softening; and this lesion probably seldom exists very long without being followed by sanguineous effusions. These *depôts* were formerly regarded merely as a secondary lesion; but Professor Lallemand, of Paris, has clearly shown that, so far from being the case, the softening generally precedes the hemorrhage, and is one of the principal causes of its occurrence.

The form of the body, also, appears to give a predisposition to the disease, as a large head, short neck, broad shoulders, and corpulency of habit; though this is probably much less frequent than is generally imagined. In the cases analyzed by Rochoux, only ten were fat and plethoric persons, whilst the rest were either spare and thin, or of the ordinary conformation. Apoplexy is of more frequent occurrence in men than in women, probably from the former being more addicted to all kinds of excesses, both bodily and mental, than the latter.

\* See the interesting case of aneurism of the basilar artery, by Dr. Serres, in "*Archives de Médecine*," vol. x., p. 419.

† *Recherches sur l'Apoplexie*, p. 418. Paris, 1833.

Of the greater prevalence of this disease in the male than in the female sex, the statistical tables of M. Falret furnish conclusive evidence. Of two thousand two hundred and ninety-seven cases of apoplexy which occurred amongst the inmates of the Lunatic Asylum near Paris, from 1794 to 1823, including a period of twenty-nine years, sixteen hundred and seventy belonged to the former, and six hundred and twenty-seven to the latter, or in the proportion nearly of three to one.

Occasionally there would seem to be a hereditary proclivity to this disease, nearly as much so as in tubercular phthisis. Examples of this are related by Portal, Frank, and Cheyne, and must be quite familiar to every observant practitioner. It has been supposed that cerebral hemorrhage is more common at certain seasons of the year than at others; but this opinion appears to be directly contradicted by the observations of Rochoux.\* Of the sixty-nine cases of this lesion observed by this able writer, sixteen occurred in the spring, nineteen in the summer, eighteen in the autumn, and sixteen in the winter.

The symptoms of cerebral apoplexy being minutely described in our practical treatises, I deem it unnecessary to dwell upon them here. I will only further remark, therefore, in concluding this subject, that one of the most interesting and important circumstances connected with encephalic effusions, whether of blood, of water, or of pus, is, that the paralysis which so often attends them occurs nearly always on the side of the body which is opposite to that on which the extravasation has its seat. So common is this phenomenon that, in the language of an able pathologist,† it may be considered as a law, the most general, perhaps, of any in medicine. Thus, when there is a clot of blood in the right hemisphere, there will be palsy of the left side; and, conversely, when there is effusion on the left side, there will be loss of motion on the right. The reason of this must be obvious to every one who has a knowledge of the decussation of the fibres of the medulla oblongata; for it need scarcely be observed that it is upon this that it depends. The occurrence, however, is by no means invariable,—an anomaly for which it is difficult to account.

In addition to the several forms of cerebral disease which have now been passed in review, and which may almost all be considered, in some way or other, as the result of inflammatory irritation, there are various morbid growths to which it will be necessary, in the next place, to turn our attention.

Amongst these productions the most important, in a pathological point of view, are tubercles, melanosis, encephaloid, cartilaginous transformations, calcareous deposits, serous cysts, hydatids, adipous and adenoid tumors.

*Tubercles* of the brain are found chiefly in childhood, seldom in very young infants, and still more rarely in adults. The disease, there is reason to believe, is of very infrequent occurrence in the United States; for, extensively as I have been engaged in post-mortem examinations, I have never seen it, except in one solitary instance. When present, it is commonly associated with a scrofulous habit of the constitution, and hence occurs most frequently in conjunction with tubercles of the other organs, especially of the lung, spleen, and mesenteric ganglions.

The localities of the brain in which tubercles are most commonly found are, the cerebral hemispheres, cerebellum, great commissure, medulla oblongata, cerebral and cerebellar crura, the optic thalami, and striated bodies,—the frequency of their occurrence being in the order here enumerated.‡ They

\* Op. cit., p. 429.

† Stokes on Apoplexy. American Journal of Med. Science, vol. xvii., p. 188.

‡ Andral, Pathological Anatomy, vol. ii., p. 485.



may occupy, indifferently, the cortical or fibrous substance; and occur either in groups, or, as is more commonly the case, in disseminated masses.

The number of these bodies seldom exceeds half a dozen; nevertheless, cases occasionally occur in which we find as many as twenty, fifty, seventy-five, or even a hundred. In size, they vary from that of a pea to that of a walnut, their magnitude being generally in an inverse ratio to their number. Not unfrequently they are so large as to occupy the greater part of one of the lobes of the cerebellum, or of one of the hemispheres of the cerebrum. In form, they closely resemble tubercles in other organs and textures. In some instances, especially when they are clustered together, which, however, is very rare, they are uneven, nodulated, and separated into lobes, connected by pretty dense cellular tissue. Their color is a pale yellow, white or bluish, and their consistence like soft cheese, though occasionally much firmer.

Apparently void of vessels, these bodies exhibit no trace whatever of organization; yet that they are so, cannot be well doubted. In the generality of cases, if not in all, they are surrounded by a distinct cyst, often remarkably thin, but which now and then is of great thickness, and of a fibrous, cartilaginous, or even bony texture. Of the manner of their formation little is known; but that they are here, as elsewhere, the result of a peculiar inflammatory process, is more than probable.

After these tubercles have existed for some time, varying according to circumstances, they assume an opaque, dusky appearance, and are finally converted into a soft, cheesy matter, precisely analogous to that of tubercles in other situations. Numerous abscesses are thus occasionally formed, which may be readily discriminated from such as are of a simple inflammatory origin, by the nature of their contents.

The cerebral tissue around these tubercles is variously affected. During the early periods of their formation, it is not unfrequently quite natural; but, as they proceed in their development, inflammation is often excited, which generally leads to induration, softening, or purulent infiltration.

*Melanosis* of the brain has been noticed by different authors, but as yet I have not been so fortunate as to meet with an instance of it. All writers agree in the opinion that it is among the rarest productions to which this organ is liable. Both Hooper and Carswell have beautifully delineated this heterologous formation of the brain. Though it occasionally occurs in small dots and narrow streaks, the most common form in which it appears, is that of spherical masses, of a jet-black, brownish, or livid color, varying in size from a mustard-seed to that of a hen's egg. They are distinctly circumscribed, but apparently without any cyst, and closely surrounded by healthy brain, from which they can be easily lifted with the forceps. Vessels may frequently be traced into their interior; and, when they are seated on the convoluted or figurate surface of the organ, it is not unusual to find them intimately adhering to the pia mater. Their softness is often remarkable, the black coloring matter which they contain being nearly as fluid as ink.

If these tumors be divided with a sharp knife, and washed with water, the coloring matter disappears, and nothing but a soft, shaggy substance, of a cellulo-fibrous nature, remains. This, no doubt, is the nidus in which the melanotic matter is originally deposited.

*Encephaloid* is occasionally met with in the brain, though much less frequently than in other parts of the body. It occurs chiefly in young subjects, before the age of twenty, in the form of soft, spongy, compressible tumors, enveloped by a distinct cyst. Their surface is frequently lobulated, and their

interior closely resembles the grey substance of the brain, with a tinge of red. When cut with a knife, the section is smooth, and the instrument is covered with a soft, unctuous, cream-like matter. The capsule itself, varying in thickness from one to several lines, is often of a deep reddish color, liberally furnished with vessels, externally flocculent, and closely adherent to the surrounding parts. Solid masses of extravasated blood are occasionally intermixed with these tumors; in many cases the cerebral tissue immediately around them is in a state of softening.

Masses of *cartilage* have been found in the brain; but they are uncommon. They may attain a very considerable volume. In a case related by Dr. Monro, the tumor was as large as the two fists. They are generally of an irregularly rounded shape, with a rough, lobulated surface; of a dense, gristly consistence; and of an opaque, bluish color; internally they present a radiating, fibrous arrangement, not unlike an unripe pear. When old, they not unfrequently contain small cavities, filled with curdy, gelatinous, or sanguinolent matter. They are seldom, if ever, enveloped by a distinct cyst.

Equally infrequent are those *calcareous deposits* which have been described by authors as being sometimes found in the brain. They may occur at all periods of life, but are much more common in the old than in the young; consumptive subjects are said to be most prone to them. The form in which they generally appear is that of scattered granules, about the size and shape of saw-dust; often, however, they are seen in irregular nodules, varying in volume from a small pea to a large plum. Composed chiefly of phosphate of lime, in combination with a minute proportion of animal substance, these concretions are commonly of the consistence of dry mortar, and readily yield to the pressure of the finger. Cases have been observed in which they were formed of alternate layers of chalky matter and solid albumen. Their color is ordinarily somewhat reddish; their surface rough, lobulated, or spicular; and, in most instances, they are surrounded by a delicate vascular membrane, which connects them to the contiguous cerebral substance.

The number of these granular concretions is sometimes immense. Dr. Hooper states that he has seen the greater part of the fibrous structure of one of the cerebral hemispheres converted into a soft, brownish mass, literally filled with small gritty particles, none of which were visible to the naked eye, and which felt between the fingers as if sand were mixed with it. Some of the small vessels of the brain are occasionally ossified, so as to present the appearance of thin, white bristles. Of this I have seen several examples, principally in very aged subjects. In one, an old man upwards of sixty, they were extremely numerous, and occupied the greater part of the posterior lobe of the left hemisphere.

No where are these concretions so common as in the pineal gland. In this situation, they are almost always agglomerated into an irregular-shaped mass, varying in magnitude from a pin-head to an apple-seed, the largest being usually in the centre. They are of a yellow citron color, hard, rough, and gritty, and, what is remarkable, are never found until about the age of seven or eight years. After this period, there are few individuals in whose brains they do not occur. Their presence does not seem to occasion any particular inconvenience; yet Descartes and some of his disciples thought that they might often be a cause of mental derangement.

Small cysts, containing a transparent yellowish fluid, of the character and consistence of serum, are sometimes met with in different parts of the brain, especially at its base, on the floor of the lateral ventricles, and on the convoluted surface of the hemispheres. Of this variety of morbid growth, I

saw, not long ago, an interesting case, in a hydrocephalic child ten months of age. The tumor, situated at the posterior and inner part of the right ventricle, which was itself enormously enlarged, was about the size and shape of a hen's egg, with perfectly smooth, polished, and transparent coats, not thicker than the healthy omentum. The fluid which it contained was thin and colorless, like the clearest spring-water. But such are not always the appearance of these cysts. Often they are quite opaque, speckled with greyish dots, and almost of the thickness and density of the pericardium. Their contents, in such cases, are of a milky-white, gelatinous, and readily coagulable by heat, which is not the case when their structure is very delicate. Several such tumors are occasionally found in the same brain, either in different parts or in close proximity with each other. Hooper has delineated a case in which three vesicles, each nearly as large as an orange, were embedded close together in the right hemisphere, occupying almost the whole of the anterior and middle lobes. That these structures are organized, is sufficiently shown by the fact that numerous vessels, of the most delicate appearance, are frequently seen ramifying through their walls.

There is another species of vesicular tumor which is occasionally seen in the substance of the brain, but the occurrence of which is much less frequent than the one just described. It is the *acephalocyst*, or headless hydatid. This animal, which has a life of its own, is enclosed in a distinct membranous sac, and seldom acquires any great size. Rostan mentions a case, however, in which the cyst was five inches in length; and a still more remarkable one is referred to by Abercrombie, in which it was nearly of the dimensions of a tin cup. It occurred in an old man, in the left ventricle, and was perfectly distinct from the choroid plexus. The fluid of this species of tumor is generally remarkably thin and pellucid. Although it is stated by numerous authors that they have seen examples of this headless hydatid, its occurrence must, nevertheless, be acknowledged to be extremely rare; Dr. Hooper informs us that he has inspected several thousand subjects without once meeting with it in the brain.

The *bladder-tailed hydatid*, the *cysticercus cellulosus* of naturalists, has never been found in the human brain; it is true that cases of it are mentioned by authors, but it is doubtful whether they are authentic.

The *adipous tumor* is rarely found in the brain. It varies in size from a small hickory-nut to a hen's egg; is rough and lobulated on the surface; of the color of fat or adipocire, and of the consistence of spermaceti, tallow, or soft wax. A fine, delicate, vascular cyst usually envelopes it; and, when divided, it is found to be composed of very minute and closely aggregated lobules. Occasionally it is made up of concentric layers, united by dense cellular tissue; and Otto saw a tumor of this kind which contained hair.

Our knowledge concerning the precise nature of this tumor is still unsatisfactory. Chemical analysis has shown that it consists principally of fatty matter, with a minute amount of cholesterine. This latter ingredient is so much the more remarkable, as it has been ascertained, recently, that the human brain always contains a small quantity of it in the normal state.

The *adenoid tumor* does not seem to have been much noticed by pathologists, either ancient or modern, and hence we may justly adopt the conclusion that it is of rare occurrence. Most generally of the size of a small nut, and of an oblong shape, it is of a pale flesh color, hard, firm, but somewhat spongy in its texture, and enveloped by an appropriate vascular covering, having apparently very little connection with the cerebral substance. It may occur in any part of the brain, and in some instances is scattered in considerable



numbers through different portions of it. In a case mentioned by Mr. Earle, of London, not less than seven such tumors were found in the substance of the right hemisphere of a child under three years of age; the largest about the size of an orange, the smallest of a chestnut. They were of a very firm texture, and of a dusky red color, like an absorbent gland, interspersed with streaks of white.

The origin of adenoid tumors is still involved in obscurity. Taking into consideration, however, their fibrous texture, and flesh-colored aspect, it appears not improbable that, in the generality of cases at least, they are the result of apoplectic effusions, the blood being merely deprived of some of its red particles, and the remainder modified in such a way as to assume the characters which appertain to this sort of deposit. The supposition certainly derives great support from the fact that the subjects of these tumors are for the most part persons who have labored, at one time or other, under symptoms of palsy, apoplexy, epilepsy, or mental derangement.

The brain is sometimes *hypertrophied*. In this state, which was already known to Morgagni, and which has been more recently described by some of the French anatomists, especially by Dr. Dance and Dr. Scoutetten, the convolutions of the brain are singularly compressed and flattened, and the intervals between them almost obliterated,—the investing membranes being at the same time partially stretched, and appearing as if they were too tight for the enclosed mass. The ventricles are very nearly effaced, and the various surfaces of the organ deprived of their ordinary moisture. The cerebral substance is unusually firm, almost destitute of blood, and appears remarkable dry when cut.\* The hypertrophy commonly involves both hemispheres; occasionally, however, it is confined to particular parts; and in some instances the increased growth is so great as to produce an evident enlargement of the skull. No example of this affection has yet been met with, so far as I know, in the cerebellum; which, considering the functions of that portion of the great nervous centre, is rather extraordinary. It is chiefly witnessed in children and very young persons, particularly in such as are subject to frequent attacks of epilepsy; but even in them it is extremely rare. Dr. Copland states that he has met with it only three times in several thousand cases.†

The opposite of this state, *atrophy*, is sometimes witnessed. In idiots, in cases of hydrocephalus, and in aged persons, the brain occasionally undergoes a remarkable diminution in all its parts, both grey and white; and the same circumstance is not unfrequently observed in young people who have suffered from long-continued wasting disorders. The marks by which atrophy may be recognized are, a flaccid and shrunken state of the convolutions, interstitial cellular infiltration, peculiar stringiness of the cerebral pulp, and dilatation of the blood-vessels, either empty or filled. Conjoined with these appearances are usually thickening of the cranial bones, and distention of the ventricles.

Like hypertrophy, the affection in question may be general or partial. The latter variety is most commonly seen in the striated bodies and optic couches. In place of the natural rotundity, the surface of these structures is remarkably flattened, contracted in its dimensions, or even scooped out, as it were; and, on cutting into them, their substance appears loose and cellulated. Very frequent instances of partial atrophy are witnessed on the convolutions, which are either smaller and less numerous than usual, or almost wholly absent. In

\* See Dr. Dance's account of this affection, in the fifth volume of the "Répertoire d'Anatomie," &c. Paris, 1828.

† Dictionary of Practical Medicine, p 218.

such cases there is often very little grey matter. Atrophy of the cerebellum is by no means uncommon, and sometimes amounts to almost entire absence of this portion of the encephalic mass.

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## SECTION IV.

### OF THE SPINAL CORD.

Having already dwelled at considerable length upon the anatomical characters and diagnostic phenomena of the various lesions of the encephalon, it only remains to make a few remarks concerning those of the spinal cord; and these will be so much the more concise, inasmuch as the foregoing observations embrace nearly all that might otherwise be necessary to be said under the present head.

*Suppuration* of the spinal cord is attended by nearly the same symptoms and anatomical characters as that of the brain, making proper allowance, of course, for the difference of function of these two organs. The following case, which I quote from the admirable work of Dr. Abercrombie, conveys an accurate idea of the phenomena which this disease exhibits before and after death. A young soldier, shortly after recovering from an attack of petechial fever, was affected with pain in the back, difficulty of moving the inferior extremities, retention of urine, and involuntary discharge of fæces, with general debility, and emaciation. This state of things was succeeded, in a few months, by perfect paralysis, first of the lower, and soon after of the upper limbs. He then lost his speech, became completely immovable, and expired suddenly, a fortnight after, in the full possession of his intellectual faculties. On inspection, a large quantity of serous fluid flowed from the spinal canal, and the cord itself, at the part corresponding to the inferior portion of the dorsal region, was suppurated, and converted into a soft, pulpy mass. Above this point, the cord preserved its natural figure, but was much reduced in consistence. The investing membranes, and the periosteum lining the vertebral canal, were destroyed along the principal seat of the disease; but the bones themselves, and their ligaments, were sound.

In another case, occurring in a woman fifty-six years of age, and narrated by Velpcau, the cervical portion of the spinal cord presented a cavity three inches in length by three lines in diameter, which was filled with soft, purulent matter, mixed with grey substance. The membranes were considerably indurated, and the walls of the abscess hard, firm, and about the eighth of an inch in thickness. The patient, in this case, was affected with sudden loss of power of the limbs of the left side, which soon amounted to perfect palsy, without deprivation of feeling. The speech was embarrassed, the voice very feeble, the respiration quick and hurried, and the left arm œdematous. In four days, she could make herself no longer understood; the strength rapidly failed, stertorous breathing supervened, and in a week she expired.

Abscesses of the spinal cord are extremely rare, and, so far as I am aware, besides the above case, only two others are on record. One of these is by Dr. Carswell, of London, and the other by Dr. Hart, of Dublin. Both Andral and Abercrombie state that they have never met with them.

*Softening* of the spinal cord is not uncommon; it may be partial or general,

and in some instances it is limited entirely to the internal grey substance. Cases occur in which the disorganized texture exhales an odor similar to that of sulphureted hydrogen.

*Induration* of the spinal cord, although it chiefly affects the white substance, is sometimes entirely confined to the grey. The affection may embrace the whole cord, from one extremity to the other. In such cases, the induration may be so great as to enable the organ, after being divested of its tunics, to resist considerable efforts at lacerating it. Of this, a remarkable case has been given by Billard, in an infant that died soon after birth from convulsions. The whole cord was found indurated, and so strong as to sustain nearly a pound weight. The meninges were lined with a thick, adventitious membrane.

Tubercles, sanguineous and serous effusions, and various kinds of tumors, are met with in the spinal cord, or in its membranes; but these it is unnecessary to describe, inasmuch as they are of the same nature precisely as in the brain. Ulceration of the spinal cord has not been described as a distinct lesion.

*Hypertrophy* of the spinal cord is uncommon, much more so, indeed, than of the brain. The affection is characterized by the enlargement and extreme firmness of the cord, with diminution of the natural vascularity, and has hitherto been noticed principally in children. Occurring generally in isolated portions, the hypertrophy is sometimes observed throughout the whole extent of the cord, which may attain such a volume as to fill completely the vertebral canal.

*Atrophy* of the spinal cord is occasionally observed. Dr. Ollivier, of Paris, gives an account of two cases of this affection, in one of which the cord was reduced, throughout its whole extent, to about two-thirds of the natural bulk, in the other to one-half. In most instances, however, the atrophy is partial, that is, limited to particular portions. The spinal cord is sometimes absent as a congenital defect; and instances are occasionally observed, in which it is hollow, at the expense, evidently, of the central grey substance.

It only remains that we should add to this rapid sketch a few remarks on the subject of *hydro-rachitis*. This is a congenital deformity, consisting in a cleft condition of the vertebral column, with a protrusion of the lining membranes of the spinal cord. The lesion, which is evidently caused by an arrest of ossification, and a consequent deficiency of the vertebral rings, is generally situated in the lumbar region, but occasionally it affects the dorsal or cervical portions, or even those of the sacrum. It is frequently associated with hydrocephalus, and is precisely analogous to all those malformations which originate from a want of union of the two halves of the fœtus during utero-gestation, such as hair-lip, cleft-palate, and opening of the linea alba.

The malformations of the spinal column accompanying this affection have been arranged by Fleischmann\* under the following heads: 1, division of the entire vertebra, even of its body; 2, partial or complete absence of the lateral arches; 3, perfect development of the lateral arches with want of union at the median line. Of these varieties the first is very rare; it may occur in any portion of the spinal column, even in the atlas and sacrum, and when the cleft is considerable, the hydro-rachitic tumor may project into the abdominal cavity, immediately behind the peritoneum. In the second form of the affection, all the arches may be wanting on one or both sides, or they may exist on one side, and be absent on the other. They are frequently very short, stunted,

\* De Vitiis Congenitis circa Thoracem et Abdomen: Erlangen, 1822.



curved or distorted, and even fused together, either in part, or in whole, by bony or cartilaginous matter. In the third variety, the lateral arches are well-formed, but open behind. The cleft varies in breadth from a few lines to half an inch or upwards. Occasionally, though rarely, the arches are bent outwards, so as to form a plane continuous on each side with the body of the bone. These three varieties, which may involve one or more pieces at the same time, are generally associated with defective development of the spinous processes.

The protrusion of the spinal envelopes generally takes place during the latter months of fetal life; occasionally, however, it is not observed until some weeks or even months after birth. When the tumor first shows itself, it is perhaps not larger than a pea; but, as the disorder progresses, it gradually increases in size, varying in proportion to the deficiency of the vertebræ. Although, in the plurality of cases, the swelling does not exceed an orange, yet occasionally it reaches the magnitude of the fist, or even that of the patient's head. The skin is commonly very smooth, delicate and thin; sometimes, however, it retains its normal thickness, or it becomes red, rugose, and horny: in a few rare cases, it is entirely wanting. The tumor is either soft, flabby, and fluctuating, or it is full, hard, and shining: when pressed upon, it gradually diminishes in volume, or completely recedes; but no sooner is the force removed than the fluid re-accumulates, and the part regains its previous bulk. In its form, the swelling is globular, ovoidal, or pear-like, with a short, narrow neck, by which it reposes upon the cleft bone. Fig. 104, from a preparation in my possession, exhibits a tumor of this kind situated in the lumbar region; it was about the size of a common orange, and was taken from a child five months old. Its cavity, which is here laid open, had been exposed by ulceration.



Fig. 104.

The fluid of a tumor of this kind is generally of a thin, limpid character, slightly saline in its taste, and almost uncoagulable. The best analysis that has been furnished of it is by Berzelius, according to which it consists of the following ingredients:

Water	-	-	-	-	-	-	97.8
Muriate of soda	-	-	-	-	-	-	1.0
Albumen	-	-	-	-	-	-	0.5
Mucus	-	-	-	-	-	-	0.5
Gelatine	-	-	-	-	-	-	0.2

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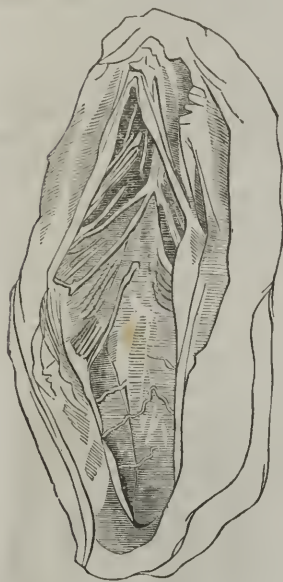
100.0

In some instances, the fluid is of the color and consistence of synovia, or it contains flakes of lymph and particles of pus. These appearances are seldom present until after the tumor has burst, and discharged its original contents. In regard to its precise seat, it may be mentioned that it is most frequently found in the arachnoid sac, but occasionally it has been known to exist between it and the pia mater, between it and the dura mater, and sometimes, though rarely, in all these situations at the same time. The tumor usually consists of

one, but in a few rare instances of two or more distinct cysts, as in the multilocular variety of ovarian dropsy. In such a case it would be difficult, if not impossible, to draw off all the fluid by a surgical operation.

The contents of the vertebral canal in the immediate neighborhood of the lesion are variously affected. The portion of the spinal cord surrounded by the tumor is often very much softened or converted into a thin, diffuent substance: sometimes it has been found abnormally hard; sometimes it is not so large as natural; and sometimes it deviates remarkably from its accustomed route, being forced through the opening in the vertebra, and partially contained in the swelling.

Fig. 105.



The nerves are always more or less displaced, and, in some instances, they are dragged out of the spinal canal, and distributed over the internal surface of the cyst in a beautiful plexiform manner, ingeniously compared by Burgius to the fleshy columns of the heart. This appearance is well seen in Fig. 105, from a specimen in my collection. The arachnoid membrane and dura mater are usually not much altered in the early stage of the affection; but as the fluid accumulates, they become excessively attenuated, and, together with the superimposed skin, finally give way in one or more places. When this happens, the parietes of the tumor shrink, and become greatly thickened, by the deposition of plastic lymph upon their interior. A thin, turbid

fluid, mixed with pus, continues to exude from the part, and the patient is rapidly carried off by constitutional irritation. The preternatural aperture is ordinarily limited to the posterior surface of the bone, but sometimes it extends through its whole substance, so that the finger may be readily passed into the abdomen, or coils of intestine find their way into the tumor.

## SECTION V.

### OF THE NERVES AND THEIR GANGLIA.

Considering their connections and functions, the nerves may be divided into two general classes, the encephalo-spinal and the sympathetic. The former, as their name imports, extend from the encephalon and spinal cord to sentient and irritable textures, acting thus as sentinels to the parts between which they are situated. The latter form a system by themselves, but freely communicate with the other by appropriate filaments: they reach from the cranium to the pelvis, lying along the vertebral column, and are particularly distinguished by a chain of ganglia, each of which is thought to be a special centre of the nervous influence. The distribution of their branches is very extensive, as much so, apparently, as that of the encephalo-spinal nerves; and their chief duty is to preside over the functions of organic life.

The form of the nerves is in general cylindrical ; but, as they proceed to their termination, they become somewhat flattened, particularly those which lie immediately beneath the skin. The aggregate of their branches, like that of the blood-vessels, is greater than that of the trunks from which they arise ; and hence they may be considered as gradually augmenting in size as they extend from their origin towards their points of destination. The encephalo-spinal nerves seem to be all implanted into the fibrous texture of the great central mass ; but this is rather apparent than real ; for, by a careful dissection, they can be distinctly traced as far as the granular matter. This connection, which was first noticed by Vicq d'Azyr, has been particularly insisted upon by Gall, and is now generally admitted by anatomists. Each cord arises alike by two roots, one from the anterior, the other from the posterior lateral groove. This remark holds good only of the spinal nerves : the origin of the encephalic nerves is less uniform and simple. In what mode the nerves terminate has not been ascertained, excepting in the instance of the optic and auditory, each of which expands into a soft, delicate, and transparent pulp, that becomes opaque soon after death. All that is known with any degree of certainty is, that, as they approach their final destination, they assume a peculiarly pulpy aspect, owing, no doubt, to the excessive attenuation of their neurilema.

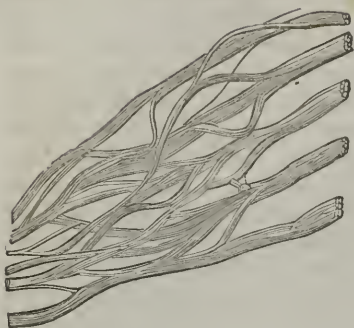
The encephalo-spinal nerves, viewed in reference to their functions, are divisible into three classes, the sensific, motor and respiratory. The first set, with the exception of the olfactory, optic, and auditory nerves, all arise from the posterior part of the spinal marrow, and are connected each with a spherical ganglion, which is situated within the vertebral canal, and the section of which deprives the parts supplied by their corresponding filaments of sensation. The motor nerves take their origin from the anterior column of the spinal cord, and are distributed to the voluntary muscles. The nerves of the third class are detached from the "respiratory tract," so beautifully delineated by Sir Charles Bell. This term is applied to a rod of white nervous matter which is interposed between the roots of the other nerves, from the annular protuberance as low down as the first dorsal vertebra. The nerves which arise from it have single roots, but they all commence by a series of minute fibrils : they possess the power of associating the muscles upon which they are spent, with the general respiratory movements, and their importance is therefore felt at every moment of our existence. They consist of the pathetic and facial nerves, the glosso-pharyngeal, spinal accessory, the phrenic, external thoracic, and the pneumo-gastric,—the latter of which is the great centre of the respiratory system.

Although the nerves are distributed in every direction through the body, yet they do not terminate in all the tissues indiscriminately. The parts in which they are most abundantly found are the eye, ear, and nose, the external and internal integuments, the voluntary and involuntary muscles, the lungs, liver, spleen, and kidney. The blood-vessels, bones, and fibrous textures are sparingly supplied, particularly the two last. The parts in which no nerves have hitherto been discovered are the ligaments and tendons, the cellular substance, the fibro-cartilages, and cartilages, the serous and synovial membranes, the humors of the eye, the epidermis, nails and hair, the lymphatic ganglions, and, lastly, the cerebro-spinal mass, the source and fountain of all sensation.

There are three modes by which the nerves are connected with each other, namely, by anastomosis, by plexus, and by ganglia. Of these, the first is generally found between branches of the same class of nerves, but occasionally between those of the opposite ones. Thus, the intercostal



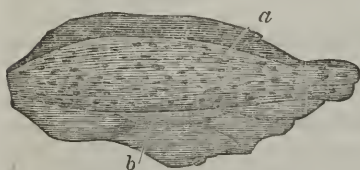
Fig. 106.



nerves, as they are called, freely anastomose with the filaments of the sympathetic; the branches of the fifth pair, which is a sensic nerve, with those of the seventh, which is a respiratory nerve. A plexus (Fig. 106) is only a more multiplied and intricate anastomosis. The most remarkable example of this kind of intercourse is furnished by the reciprocal interlacement of the axillary nerves.

Ganglia (Fig. 107) are small nodules, of a reddish grey color, which consist of an interlacement of fine nervous fibrils, held together by soft, cellular substance. In size, they vary in different parts of the body, from that of a pin head to that of a kidney bean; usually they are somewhat flattened, and of an irregularly oval shape. They are of a firm consistence, yet easily compressed; and, when divided, they exhibit somewhat of a pulpy appearance. Like the corresponding bodies in the lymphatic system, they are enveloped by an external covering, which is quite dense, and connected with the dura mater, in the spinal ganglia, but very thin and indistinct in those of the great sympathetic.

Fig. 107.



A nervous ganglion: *a*, internal structure; *b*, proper envelope.

By boiling, the ganglia first harden, but subsequently they become soft and shreddy: the alkalies dissolve them only partially, and they resist putrefaction

for a long while. Their vessels are derived from the neighboring branches, and can be readily filled with injecting matter. They are also rendered very apparent after inflammation. To this sketch of the ganglia it should be added, that those of the great sympathetic — to which the foregoing remarks are intended more particularly to apply — are all embedded in the cellular substance, and that each of them may be viewed in the light of a small nervous centre, from which are detached filaments of communication to the encephalo-spinal nerves, and of distribution to the neighboring organs, bringing thus the nervous system into one harmonious whole.

The chemical composition of the nerves is analogous to that of the encephalo-spinal mass. By immersion in alcohol, they are readily hardened, and a long time elapses before they yield to the influence of putrefaction. They are extensible, inelastic and void of irritability, but highly sensitive.

Every nerve is composed of two principal elements, which bear to each

other the relations of contained and containing parts. (Fig. 108.) The first is of a soft pulpy consistence, of a white, yellowish color, and made up of the same materials as the white texture of the brain, with the addition, perhaps, of a minute quantity of granular substance. Like the former, it consists of excessively delicate fibres, which

Fig. 108.



A portion of nerve invested by its neurilemma, and consisting of distinct filaments, one of which is drawn out and transfixed by a pin.

are arranged in close parallel lines, and extend from one extremity of the nerve to the other. (Fig. 109.) Each filament is enclosed by a distinct sheath, which is firmly united to those around it by cellular texture. The number

of fibres entering into the formation of any one nerve is not ascertained: some have only a few; whilst others, as, for example, the sensifc portion of the fifth pair of the cranium, have as many as sixty or eighty. When relaxed, many of the fibres have a convoluted, zigzag arrangement, which is particularly observable in some of the inferior animals, as the horse, ox, dog, and deer. Whether each filament is a solid cylinder, or a hollow tube, is not ascertained.

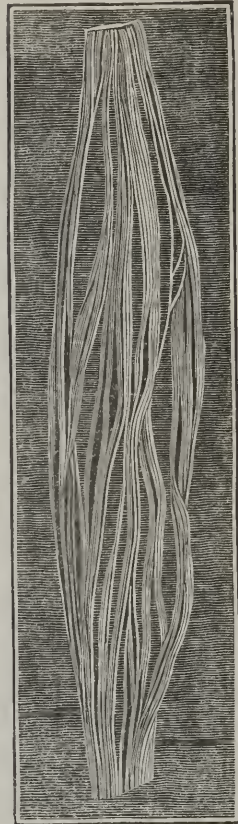
Thus constituted, each nerve has its appropriate envelope, as each fibril has its appropriate sheath. The nature of this investment has been a subject of much controversy; without stopping to inquire into the various opinions that have been advanced concerning it by authors, I will merely state that it appears to me to be distinctly fibrous in its structure, and consequently analogous to the coverings of the muscles. In its thickness, it varies in different regions of the body; and, in some of the nerves, as the olfactory and auditory, it is either entirely absent, or so attenuated as to render it impossible to demonstrate it. Externally it is connected to the surrounding parts by cellular tissue, whilst from its inner surface are detached numerous processes, that form so many canals for the reception of the pulpy substance previously described. These sheaths can be rendered apparent by injecting them with quicksilver after their contents have been dissolved in dilute alkali.

The nerves are liberally supplied with blood. The arteries are derived from the neighboring trunks, and, as they approach the neurilema, each subdivides into two branches, one of which pursues a forward, the other a retrograde direction. How the ultimate ramifications are spent it is impossible to say, though it is not unlikely that they all terminate in the sheath of the nervous fibrils, the latter having no particular connection with them. When the arteries are filled with size, colored with vermillion, the nerves exhibit a red florid appearance, and might be supposed to consist almost wholly of a tissue of vessels. The veins are numerous, and pursue, for the most part, a very tortuous course. As in the brain, no absorbents have yet been traced, except in the neurilema of a few of the larger trunks.

The nerves are liable to acute and chronic inflammation, suppuration, ulceration, gangrene, hypertrophy, atrophy, and different kinds of tumors.

When a nerve is cut across, restoration generally takes place in a short time by the adhesive process, the small cicatrice thus formed offering no obstacle to its functions. When a portion is removed, the divided extremities, in the course of twenty-four hours, become enlarged and vascular, and the surrounding cellular tissue, taking on inflammation, pours out coagulating lymph, which finally encloses and cements them together. After some time, varying according to the thickness of the nerve, and the distance between the divided ends, the matter thus effused is organized, assuming a whitish,

Fig. 109.



Nervous fibres deprived of their covering, and unravell'd, showing their component filaments.

gristly appearance, and the function of the organ is either partially or wholly re-established. Sensibility commonly returns more quickly than voluntary motion. Mr. Mayo found that the sentient nerves, when thus mutilated, generally began to regain their functions early in the third week, while the motor nerves did not recover any of their powers till after the fourth. It is proper to observe, that if the interval between the divided extremities is very great, as from one to two inches, the union is either extremely imperfect, being effected solely by condensed cellular tissue, or, what is more commonly the case, nature entirely fails in her efforts, and the function of the part is thus forever destroyed.

In *acute neuritis*, the nerves are of a bright reddish color, their capillary vessels, which run longitudinally, being united by thousands of transverse twigs, which, in the normal state, always elude our closest scrutiny. When the inflammation is very intense, the affected part generally assumes a dark violet tint, either uniformly diffused, or occurring in small patches, like so many ecchymoses. These changes are always most distinct in the neurilemic coat; but by degrees they extend to the interstitial cellular substance, which at the same time becomes distended with serous, bloody, or purulent fluid, the natural tendency of which is to separate the filaments of the nerve, and give it a tumid aspect. As the disorder progresses, the affected part loses its peculiar texture, diminishes in strength and consistence, and resembles a cord of inflamed cellular substance rather than a nerve.

This disease, which seems to occur much more frequently in the sciatic and facial than in any of the other nerves, is characterized by the most torturing pain, augmented by pressure, and accompanied generally by a peculiar numbness of the affected part. The pain often occurs in paroxysms, observing a regular periodicity; and, after it has existed for some time, it usually becomes less violent, but more constant.

It would appear, from the researches of Gendrin, that inflammation of a nerve, when artificially induced, always has a tendency to excite inflammation in the organ to which it is distributed. Thus, inflammation of the fifth pair will produce ophthalmia; of the eighth pair, gastritis; but what is remarkable, not pneumonitis. The reverse of this probably sometimes occurs, the inflammation being propagated from the organs to the nerves.

The anatomical characters of *chronic neuritis* are, increased vascularity and consistence of the affected part, with slight swelling and friability. The neurilemic coat is considerably indurated, the interstitial cellular substance is infiltrated with serous fluid, and the capillary vessels are often so much loaded as to exhibit a varicose arrangement. This affection, which is probably much more common than has been generally imagined by pathologists, is almost always attended with severe pain, and, like the acute form, may be confined either to a small portion of a nerve, or diffused over an extent of several inches.

*Suppuration* of the nerves has been noticed by different writers, though there is reason to believe that it is very rare. The matter, which is commonly of the character of healthy pus, is usually infiltrated into the interfibrillar cellular tissue, in which it appears to be originally developed, the nervous substance itself being little altered. Occasionally the pus lies immediately beneath the neurilemic coat, which it raises in the form of a little abscess. Bloody effusion was found by Martinet in the sciatic nerve of a man who had been affected with excruciating pain in the posterior part of the thigh, aggravated to almost absolute intolerance by the least motion; and Cotunni noticed, long ago, that serous infiltration is often connected with neuralgia.



*Ulceration* of the nerves is still more rare than suppuration. It never occurs spontaneously after inflammation, but is always dependent upon injury or disease of the adjacent structures. In a case of ulceration of the peroneal nerve, reported by Mr. Swan, of London, there was a fungous ulcer of the leg, with violent pain of the whole limb, which rendered it necessary to amputate.

*Gangrene* of the nerves, like ulceration, is generally complicated with lesion of the surrounding parts, being seldom, if ever, present as a primary affection. In whatever manner it may be induced, the nerves are of a dark brownish color, highly offensive, and converted into soft, pultaceous cords, entirely destitute of their natural characters. The parts immediately above and below the seat of the disorganization are of a reddish tint, swelled, and infiltrated with serous fluid, — phenomena indicative of inflammatory irritation.

*Carcinoma* seldom affects the nerves, at least very few well-authenticated cases of this disease are to be found in the records of pathological anatomy. Marandel has witnessed it in the external saphenous nerve; Dupuytren, in the posterior tibial; Lévêque-Lasource, in the trifacial; Martin, in the median; and I have myself met with it in the optic nerve. Dupuytren saw the trifacial nerve transformed into cerebriiform substance, and the Gasserian ganglion remarkably large and carcinomatous. The whole facial branch had experienced the same alteration. A similar case has been published by Begin.

Berard has published an example, the only one of which I have any knowledge, of melanosis of these cords. The heterologous matter was embedded in the right phrenic nerve, and presented itself in the form of a blackish tubercle, of the volume of a small pea, and of a firm scirrhous-like consistence.

Of *tubercular* disease of the nerves hardly anything is known. I have never met with it, and very few instances of it are on record. Mons. Nelaton, of France, has related a case in which this deposit took place in the origins of the third, fifth, seventh and eighth pairs of nerves, which were all very much enlarged, and the seat of small spheroidal tumors, from two to three lines in diameter, and composed of yellow, opaque matter, evidently of the nature of that in question. The subject was a female twenty-one years of age.

The nerves are occasionally found in a state of *hypertrophy*. In chronic affections of the leg, nothing is more common than to see the subcutaneous nerves thickened and injected. In dissecting, not long ago, the left leg of a man, thirty years old, removed for caries of the tarsal bones, I found the posterior tibial nerve, nearly in its whole length, very much indurated, and at least three times as thick as usual, all its fibres being extremely distinct and well-defined. Similar appearances have been noticed by Gendrin, Martinet, and Swan. The ends of the nerves, after amputation, often become very large, and have their sensibility morbidly increased. Occasionally the hypertrophy, although strictly local, affects a considerable number of nerves simultaneously. Of this a remarkable instance is recorded in the London Medical and Physical Journal for 1826. It occurred in a cretin, thirty-three years old, whose body was examined by Dr. Schiffner, of Vienna. The inferior maxillary and facial nerves, together with the eighth pair, and almost all the spinal nerves, presented numerous swellings along their trunks and branches, many of which were as large as a full-grown pea. The nerves of the womb are hypertrophied during pregnancy, as has been satisfactorily shown by the dissections of Home and Tiedemann. The same phenomenon is frequently observed in subcutaneous and other tumors.

*Atrophy* of the nerves, a state the reverse of that just described, generally

arises from mechanical injury, or the pressure of a tumor; yet that it occasionally exists as a primary affection, seems undeniable. Whenever an organ of sense is destroyed, the nerve leading to it wastes, usually by degrees, but sometimes with great rapidity. In such cases, the nerve assumes a peculiar buff-colored appearance, and often shrinks to less than one-third its normal bulk, its pulpy substance being sometimes totally absorbed, so as to leave nothing but the dense and indurated neurilema.

Small *tumors*, the anatomical characters of which seem to be variable, are sometimes developed in the nerves, the component threads of which they separate from each other like the ribs of a fan. They occur most commonly in the nerves of the upper extremity, especially in the radial and ulnar, and are generally attended with severe pain and numbness. The origin of these tumors is still involved in obscurity: in some instances, they are evidently connected with the nervous substance; whereas, in others, they arise, with equal certainty, from the neurilemic covering. In a case mentioned to me by Professor Parker, the tumor, about the size of a hen's egg, was developed in the centre of the ulnar nerve, the fibres of which it forced apart, and was of a compact solid texture, like fibro-cartilage. This, perhaps, is the most ordinary structure of these swellings. In the case described by Cheselden, it was of the hygromatous character, being composed of a dense cyst, filled with a transparent jelly-like fluid.\* Their magnitude seldom exceeds a walnut; in most cases, indeed, they are not larger than a filbert or a peach-stone. After amputation, the ends of the divided nerves are sometimes expanded into white, semi-cartilaginous bulbs, which frequently become the seat of morbid sensibility and neuralgia.

Concerning the lesions of the ganglia, very little is known with any degree of certainty. That they are liable, like the nerves with which they are connected, and of which they are a part, to inflammation and some of its more ordinary consequences, would seem probable, from the similarity of their structure; but what the resultant changes are, the present state of the science does not enable us to point out. Professor Lobstein,† of Strasburgh, has repeatedly found the thoracic ganglia and the semi-lunar plexus very much engorged with blood, and of a lively red color, from the effects, evidently, as he supposes, of inflammation; and similar phenomena have been noticed by other observers. In the yellow fever which prevailed at Natchez, in the state of Mississippi, in 1823, disease of the thoracic and abdominal portion of the great sympathetic appears to have been exceedingly common. Of twenty subjects examined by Dr. Cartwright, of that city, seventeen presented inflammation of the semi-lunar ganglia and their plexuses: their vessels were greatly loaded with blood, and their color, which varied from bright scarlet to deep black, was so completely dyed into them as to defy ablution. The cardiac and pulmonary plexuses were also affected, but much less frequently and extensively than those of the other viscera.

In connection with these morbid appearances there was generally more or less lesion of the cerebro-spinal axis, the duodenum, stomach, lung, or liver.‡ It is much to be regretted that Dr. Cartwright has not stated whether the nervous ganglia and plexuses, in the cases which he inspected, had undergone any change of consistence, or furnished any particular secretion, as this would

\* The Anatomy of the Human Body, p. 256. Boston, 1806.

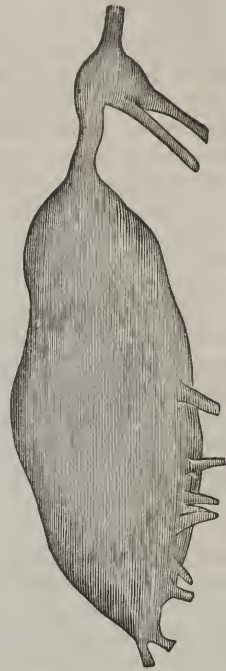
† Treatise on the Structure, Functions, and Diseases of the Human Sympathetic Nerve. Translated by Joseph Pancoast, M.D.: Philadelphia, 1831.

‡ American Medical Recorder, vol. ix., p. 37. January, 1826.

have afforded us a much better opportunity of judging in regard to the existence of inflammation than the mere fact of their discoloration.

A number of examples of considerable increase of bulk of the ganglia of the sympathetic, from the influence of chronic irritation, are recorded. The enlargement, which has been known to exceed six or eight times the normal size, is met with chiefly in the cervical ganglia; but, occasionally, it has been seen in those of the thorax and pelvis. A remarkable case of hypertrophy of these bodies, probably produced by chronic inflammation, has been published by Cruveilhier; he observed it in a subject in the dissecting-room of the "Ecole Pratique," of Paris, concerning the previous history of which nothing whatever could be learned. All the cervical ganglia of the left side were enormously enlarged, especially the middle, which was two inches and a half in length by one inch in thickness. (Fig. 110.) They were of a greyish white color, and of a very dense, compact consistence, creaking very sensibly under the knife. On further examination, they were found to be of a fibrous structure, arranged in such a manner as to form a great number of cells, filled with a sort of gelatinous substance. The component nervous filaments were in a state of complete atrophy, the only part that was left being their neurilemic covering. The nervous cords between the diseased ganglia, as well as those which passed off from them, were very much enlarged, of a pale greyish color, and abnormally firm in their consistence.

Fig. 110.



## CHAPTER XII.

### OF THE EYE.

**I. Lesions of the Lachrymal Apparatus.**—Preliminary Observations.—Lachrymal Gland —Ducts and Sac.—**II. Lesions of the Ball of the Eye.**—The Conjunctiva —Pterygium.—Lachrymal Caruncle.—Acute Corneitis.—Ulceration and Ossification of the Cornea.—Fleshy Excrescences.—Alterations of Form —Diseases of the Sclerotica.—Choroid Tunic.—The Retina.—Amaurosis.—Optic Nerve.—Membrane of Demours.—Hæmophthalmus—Lesions of the Iris.—Alterations of the Pupil.—Capsule of the Crystalline Lens.—Liquor of Morgagni.—Varieties of Cataract.—Vitreous Humor.—Heterologous Formations.

SEVERAL structures, entirely different from those in other organs, enter into the formation of the eye. Altogether it is a most complicated apparatus; and hence, as might be expected, the diseases to which it is subject are at once numerous and interesting. This renders it incumbent on us to consider them somewhat in detail; and, as being first in order, we shall begin with those of the lachrymal apparatus.



## SECTION I.

## OF THE LACHRYMAL APPARATUS.

The reader need scarcely be reminded that the lachrymal apparatus consists of the lachrymal gland, the two ducts of that name, the lachrymal sac, and the nasal canal. All these passages are lined by a prolongation of the mucous membrane of the nose, which, on its arrival at the lids, invests their posterior surface, extends into the Meibomian follicles and the excretory tubes of the lachrymal gland, and is finally reflected over the ball of the eye, forming what is named the conjunctiva. This distribution is worthy of remembrance, inasmuch as it enables us to account for the sympathy subsisting between the eye and the nose, and the facility with which disease is propagated from the one to the other.

The *lachrymal gland*, placed at the upper and outer part of the orbit, is of an elongated oval shape, of a light pink color, and about the size of a small almond. It is made up of a large number of rounded granules, similar in their appearance to those of the parotid, and united together by delicate cellular tissue. It receives a considerable amount of nervous and vascular endowment; and the fluid which it secretes is conveyed by a series of small tubes, from five to eight in number, to the surface of the eye, near its outer angle.

This body, though so easily affected by mental emotions, does not seem to be very prone to disease. Richerand and Lawrence state that they have never seen it inflamed, and the testimony of Beer and Middlemore is nearly to the same effect. That the idiopathic form of this complaint, as it is termed, is extremely rare, is certain; but that it occasionally exists, the experience of the profession fully attests. Resulting commonly from external injury, there is reason to believe that it occasionally succeeds to inflammation of the neighboring parts, especially of the conjunctiva; and the subjects of its attack are such chiefly as are predisposed to gouty and rheumatic affections.

Owing to its infrequent occurrence, the anatomical characters of inflammation of this body have not been minutely ascertained; but as far as our observation goes, they are similar to those of other glandular organs. In the early stage of the disorder, there is merely an augmented flow of tears, with slight uneasiness in the situation of the gland: as it progresses, however, the natural secretion diminishes, and the movements of the eye become constrained and painful. The vessels of the little body are engorged with blood, its substance assumes a deep reddish complexion, and the interlobular cellular tissue is infiltrated with serous fluid, the swelling from this source being sometimes quite considerable. When the inflammation is violent, it may terminate in suppuration, which, however, is extremely rare, — Mr. Guthrie, who has written ably on the eye, having met with only one instance of it in nearly twelve thousand patients. When matter forms, it usually points above the upper lid; occasionally, it escapes into the cellular tissue of the orbit, and gradually works its way out through a fistulous opening.

There is a *chronic* form of the disease, in which the gland often becomes hypertrophied, and acquires a firm, compact texture, not unlike an indurated pancreas. The enlarged organ either remains stationary, or it passes into tedious and imperfect suppuration: the disease is most frequent in scrofulous children, and is seldom attended with much pain. Chronic inflammation sometimes produces atrophy of this gland. I once dissected an encephaloid eye, in which this body was reduced to the size of a small bean, its substance

being indurated, and of a yellowish drab color. The subject of the disease was a child ten years of age.

The lachrymal gland is liable to *scirrhus*, forming a hard, elastic, lobulated mass, of the consistence of fibro-cartilage. Under these circumstances the organ may be larger than an almond, or even of the size of a hen's egg. Its substance is of a white greyish color, dense, crisp, and intersected by membranous bands, resembling the interior of an unripe pear. Small cysts, filled with thin, glairy fluid, or with firm, fatty, melliceric, or sebaceous matter are sometimes interspersed through the diseased mass. Scirrhus seldom occurs before the middle term of life ; the pain is severe and lancinating ; and there is more or less distortion of the eye, with dimness, and, in some instances, total loss of vision.

*Serous cysts*, containing a thin, limpid fluid, are sometimes found in the lachrymal gland. Although generally very small, they have been observed, in a few cases, as large as a hen's egg. That this disease is rare, may be inferred from the fact that few oculists have ever met with it. Professor Schmidt, of Vienna, to whom is due the merit of first describing it, relates only two examples of it ; and the celebrated Beer never saw it more than twice or three times. By some, these cysts have been supposed to be identical with hydatids ; but the more probable opinion is, that they are nothing but dilated excretory ducts ; and this conjecture certainly receives corroboration from the fact that these tumors are generally distended with a fluid possessing all the properties of the lachrymal secretion, being of a thin, watery consistence, and of a sharp, saltish taste.

It occasionally happens that one of the *excretory ducts* of the lachrymal gland becomes dilated near its terminal extremity, forming a circumscribed, elastic swelling, immediately behind the upper lid, towards the temporal side of the orbit. It is semi-transparent, unusually delicate, of an ovoidal shape, and often reaches the size of a pigeon's egg, though generally it does not exceed a hazlenut.

The *lachrymal ducts* are liable to inflammation, which sometimes end in supuration, at other times in the obliteration of their caliber. Similar lesions occur in the *nasal canal*. The obliteration here, however, is usually partial, existing in the form of a stricture. Though the nasal canal is scarcely three-quarters of an inch in length, there are three points in its course at which stricture may be located, namely, at its junction with the lachrymal sac, at its middle, and at its entrance, into the nostril. The disease is produced in the same way precisely as stricture of the urethra ; that is to say, by inflammation of the lining membrane, accompanied with effusion of lymph into its substance, and into the subjacent cellular tissue. Permanent obstruction, either partial or general, may also be produced by inspissated mucus, and by fibrin poured upon the free surface of the membrane.

M. Bouchardat\* has recently published the case of a woman sixty-six years of age, whose lachrymal canal contained a calculus, weighing four-tenths of a grain, composed of the following ingredients :

Carbonate of lime	-	-	-	-	48
Phosphate of lime and magnesia	-	-	-	-	9
Concrete albumen	-	-	-	-	25
Mucous matter	-	-	-	-	18
Fat and chloride of sodium, a trace.					

The diseases of the *lachrymal sac* do not require special notice, as they do not differ from those of other mucous textures. Suppuration often occurs here, and the matter, being unable to find its way down into the nose or up into the eye, is apt to escape through the skin, leaving a fistulous aperture, which it is always difficult to heal.

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## SECTION II.

### OF THE BALL OF THE EYE.

The ball of the eye, situated in the anterior part of the orbit, is of an irregularly spherical figure, its antero-posterior diameter, which is not quite an inch, being about one line longer than the other. It is composed of a series of concentric membranes lying in close apposition with each other, and arranged so as to enclose the humors of the organ. These latter are three in number,—the aqueous, the crystalline, and the vitreous, their names being derived from their appearance. The membranes, usually called the tunics of the eye, are the conjunctiva, the cornea, the sclerotica, the choroid, the membrane of Jacob, the iris, and the retina; besides which are the capsules, as they are termed, of the different humors. The organ thus contains almost every variety of elementary tissue, and hence the great frequency of its diseases, with the diversity of their progress and mode of termination.

The *conjunctiva* is a thin, mucous membrane, lining the posterior surface of the lids and the front of the ball of the eye, which it thus connects together. Near the inner angle it is folded upon itself, so as to form what is denominated the semi-lunar valve, and as it is prolonged into the lachrymal points, it may be considered as being directly continuous with the mucous membrane of the tear-bag and of the chambers of the nose. The conjunctiva is exceedingly delicate and transparent, devoid of follicles and villositities, loose and pale on the sclerotica, firm, and rose-colored on the lids. The membrane also covers the cornea, but its structure is here so much changed that it can no longer be recognized. At the margin of the lids, where it is continuous with the skin, it is reflected into the Meibomian follicles, a number of narrow, whitish, tortuous glands, designed to secrete an unctuous fluid for lubricating the eye.

The connection between the conjunctiva and the sclerotica is established through the medium of a pretty thick layer of cellular tissue, which, from the character it plays in the diseases of the eye, deserves to be dignified with the appellation of the *ocular fascia*. When carefully dissected out, it is found to be semi-transparent, strong and elastic, disappearing gradually upon the posterior part of the ball. It is remarkably well developed in the horse and ox, and I have always succeeded in making it out distinctly in the human subject. Considered in reference to its functions, it is of the same use to the conjunctiva that the cellulo-fibrous tunic, so well described by Cruveilhier, is to the stomach and bowels. It is the exclusive seat, in most instances, of the vascularity which characterizes inflammation of the sclerotic portion of the conjunctiva, and of the effusions attending it, whether of serosity, of lymph, of blood, or of pus.

Acute *conjunctivitis* is announced by more or less redness, which usually begins at the palpebral portion of the membrane, and gradually extends to that over the sclerotica. The injection is at first arborescent; by and by it becomes capilliform, and, in certain cases, it is so close as to give the organ the



appearance of being bloodshot. With this augmented redness, the membrane loses its natural polish, the temperature of the part is augmented, its sensibility is altered, and there is a suppression of the mucous as well as of the lachrymal secretion. The discoloration now becomes more and more vivid and intense; the conjunctiva assumes a villous aspect; serosity is poured out into the cells of the ocular fascia; the tears flow in great abundance; and the mucous discharge is not only restored, but uncommonly copious. Blood is sometimes extravasated beneath the conjunctiva; and occasionally there is a secretion of lymph, by which the margins of the lids are completely agglutinated. In violent cases, such as we have here described, the disease is frequently propagated to the other textures of the eye, and the discoloration extends backwards to the posterior section of the sclerotica.

Acute conjunctivitis often passes into *suppuration*. The matter, which is at first merely puriform, becomes gradually purulent, thick, and of a yellowish straw color. The quantity secreted is sometimes surprisingly great — much more so than in any other mucous membrane of equal extent — from four to eight drachms being discharged in the twenty-four hours. Like the matter of gonorrhœa, it is frequently of a highly acrid and irritating nature, and has the property, when applied to the sound eye, of engendering the same affection. Many surgeons have disbelieved this; but the experiments of Guillé, Hupsch, Kirchoff, and others — which consisted in inoculating different persons with matter taken from patients afflicted with ophthalmia — have affirmatively settled the point. The disease, when thus produced, usually appears in from one to three days.

There is a variety of this disease in which the effusion of serosity is so great, as to give the eye a truly *œdematous* aspect. The sclerotic portion of the conjunctiva is elevated into a soft, transparent tumor, forming a ring around the cornea, which appears deeply sunk, and sometimes almost entirely concealed: the effusion often encroaches considerably upon the lids, which are thus rendered tumid and everted. Very little vascularity attends this variety of ophthalmia. In severe cases, the conjunctiva has been known from this cause to form a tumor as big as a walnut.

In another series of cases, the mucous membrane is raised into small *vesicles*. Seated in the subjacent cellular tissue, they are produced by an effusion of serous fluid, and seldom exceed the size of a common pin-head; they are of a spherical shape, diaphanous, and most frequent in that species of ophthalmia which affects the conjunctival covering of the cornea. Their number is sometimes considerable; and, on bursting, they leave an ulcer which is often difficult to heal.

The corneal portion of the conjunctiva is also liable to the formation of *pustules*. Occurring in persons of all ages, they are most frequently met with in children, and sometimes spread through whole families, being generally concomitant of small-pox, measles, and aphthous affections of the mouth. The pustules are usually situated near the margin of the cornea, are encircled by minute vessels, and appear like small dusky spots, of a pale reddish color, slightly elevated above the level of the surrounding surface. If the inflammation be allowed to go on, purulent matter is formed, their apex ulcerates, their contents are discharged, and a cavity is left, the edges of which are dense and opaque. The nature of these pustules is still unknown. The most plausible conjecture is, that they are the result of inflammation of the mucous follicles, which we have reason to believe exist in the conjunctiva, although they have not yet been demonstrated.

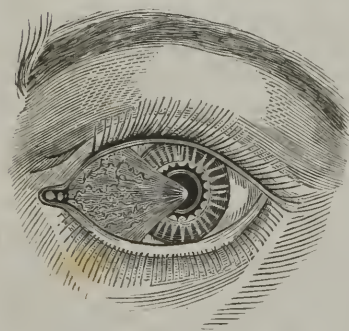
*Chronic*, like acute inflammation, usually begins in the palpebral conjunc-

tiva, and is often entirely confined to that part. The membrane, which is of a uniform reddish color, verging on purple, is thickened by an effusion of lymph, and converted into a dense, fleshy-looking substance. Its surface is always more or less rough; and, in many instances, it is studded with small, spherical bodies, improperly called *granulations*. These bodies, although they are generally dispersed over the whole surface of the lids, are always most luxuriant along their edges; and they seldom extend over the sclerotic and corneal portion of the membrane. Being of a soft, fleshy consistence, they are of a florid color, extremely vascular, highly sensitive, and liable to bleed on the slightest touch. Instances occur in which they are of the color and density of fibro-cartilage; and, occasionally, they resemble little clots of blood, being of a livid hue and of a fungous consistence. The magnitude which they attain, in cases of Egyptian and venereal ophthalmia, is sometimes surprisingly great. On the whole, it appears to me that these vegetations are nothing but enlarged villositities, with which the surface of the membrane, like every other of a similar kind, is naturally covered. Villositities have not, it is true, been demonstrated here in the sound state: but that they exist, in certain pathological conditions, my own observations fully convince me.

If the inflammation recurs from time to time, or is unusually protracted, the vessels of the conjunctiva are apt to become permanently enlarged. The veins, especially, may be observed to be tortuous, of a dark color, and irregularly nodulated, like varicose veins in other parts of the body. Whether the arterial capillaries participate in the enlargement, I am unable to say; doubtless they do in some instances. Added to all this, there is generally considerable thickening, with opacity and relaxation of the conjunctiva: the lachrymal caruncle is hypertrophied, as are also the Meibomian follicles, and the secretion from these structures is unnaturally thick and copious.

A new membrane occasionally forms on the conjunctiva, producing what is called a *pterygium* (Fig. 111), and is most common in old people, though no age is exempt from it. It is generally of a flat, triangular shape, with the apex directed towards the pupil; has a fleshy look and consistence; and almost always grows at the internal angle, tending, in its progress, to encroach upon the cornea. Its vascularity is often quite great, the vessels running in a straight line, and presenting a varicose state, especially when of long standing. In most instances, the morbid growth is soft and movable; now and then, however, it is found firmly adherent, thick, coriaceous, hard, like parchment, or even cartilaginous. Mr. Wardrop mentions a case in which there were two pterygia on each eye.

Fig. 111.



The manner in which this membrane originates is still a matter of dispute. In most cases, it seems to consist simply in a hypertrophied state of the conjunctiva; but, occasionally, it is probably an entirely new formation, commencing in an effusion of plastic lymph. As it increases, it generally appropriates to itself a large supply of vessels, which thus nourish and support it.

As an effect of inflammation, the *lachrymal caruncle*, as it is called, is sometimes hypertrophied. This structure is naturally quite small; but, when

thus affected, it often acquires the volume of a pea, or even of a cherry. It is generally of a pale reddish color, and of a soft fleshy consistence, with a rough tuberculated surface. Sometimes it is very dark, and almost black.

The *cornea* occupies the anterior sixth of the ball of the eye, and is of a circular shape, — its transverse diameter, however, being a little longer than the vertical. Anteriorly, it is convex and covered by the conjunctiva; behind, it is concave, and lined by the membrane of Demours. The proper substance of the cornea is of a fibro-cartilaginous nature, transparent, dense, elastic, and made up of five or six concentric lamellæ, connected together by short, cellular tissue, the interstices of which are filled with a clear, unctuous liquid. No nerves have yet been traced into the interior of this membrane; and, in the sound state, it is perfectly insensible.\* Its vessels, which are derived from the sclerotic coat, naturally carry a colorless fluid, and are therefore indiscernible.

The cornea, provided it be sound, readily unites when divided, the process by which this is effected being the same as in other parts of the body. If a portion be removed, it is never completely regenerated; but the chasm is filled up with an opaque substance, of a hard, cartilaginous consistence.

Although *acute corneitis* occasionally arises without any assignable cause, yet, in most instances, it is directly chargeable to external violence. In the early stage of the disease there is scarcely any perceptible alteration in the part concerned, the only change being a slight degree of haziness. By and by, however, the membrane loses its transparency, assumes a bluish milky aspect, softens, and becomes distinctly vascular, — hundreds of vessels, extremely fine and delicate, running in every direction from the circumference towards the centre. In aggravated cases, blood is sometimes effused into the substance of the cornea, or the capillary injection is so great as to give the membrane the appearance of a piece of scarlet cloth. Very often a red zone is seen round the fore part of the sclerotic coat, formed by a wreath of vessels which freely anastomose with those of the cornea. The anterior surface of the membrane is occasionally quite rough; the movements of the eye are impeded, and there is deep-seated pain in the orbit, with intolerance of light; and, in the more violent grades, hemicrania. The conjunctiva is generally extensively implicated; and, in strumous habits, the inflammation frequently spreads to the iris, the choroid, and the retina, leading to great and permanent mischief.

Acute corneitis passes sometimes into *suppuration*. The matter collects either immediately beneath the conjunctival covering, or else between the lamellæ of the proper substance of the membrane, and generally appears in the form of a small abscess. This gradually increases in size, until it produces a considerable prominence, when it either bursts, or its contents are removed by absorption. The pus, which is usually very white and mixed with lymph, occasionally escapes into the anterior chamber. The parts immediately around the abscess are always more or less softened, vascular, and opaque.

In violent grades of inflammation, especially when occurring in persons of a strumous habit, the cornea sometimes loses its vitality, and is detached in greyish, dirty-looking eschars, leaving one or more openings through which the iris protrudes. Some anatomists have doubted whether the cornea is sus-

\* Professor Schlemm, of Berlin, it is true, asserts that he has succeeded in tracing nerves into the substance of the cornea; but his dissections have not, I believe, been verified by other anatomists. (See American Jour. Med. Science, Nov. 1830.)



ceptible of this change ; but the observations of Beclard, Saunders, Mirault, and others, have affirmatively settled the question. The change is most apt to take place in the pustules which form on the eye in cases of confluent small-pox.

In *chronic* corneitis, the membrane is opaque, of a greyish tint, condensed, indurated, and thickened, yet more easily torn than in the healthy state. Vessels may be traced over its anterior surface, which are much larger than in the acute form of the complaint, and their contents seem also of a darker hue. Little pain is present ; objects are perceived indistinctly, every thing having a hazy appearance ; and, if the cornea is incised, it is generally slow in uniting. In cases of very long standing, the thickening and opacity of the cornea are sometimes very great : the surrounding textures are deeply implicated, and the ball of the eye appears as if covered with a strong fascia, the fibres of which converge towards the centre of the cornea, and exhibit a yellowish pearly lustre, not unlike the inner surface of an oyster-shell. A deposit of lymph, produced, probably, by slow chronic inflammation, is often seen around the cornea of old people, forming a regular circle which has been denominated the senile arch. It has been observed, in a few instances, in young children.

*Ulceration* of the cornea is a very common consequence of the bursting of an abscess ; but it may also take place without any antecedent suppuration. A species of softening sometimes precedes this process, leading to the formation of an immense number of erosions, so exceedingly minute as almost to escape the naked eye : they are superficial, rough, irregular, and without any circumjacent vascularity. In the majority of cases, however, the ulceration presents a more decided character ; it is deep, well-defined, and of a pale ash color, with high, jagged edges ; its surface is bathed with a thin acrid fluid ; the part is extremely sensitive ; and the sore manifests a strong tendency to spread in depth and diameter. In this manner the disease often progresses until the cornea gives way, and there is an escape of the aqueous humor, or, what is worse, a total destruction of the organ. In old people we sometimes meet with crescentic ulcers situated near the circumference of the cornea, which, however, seldom reach to any great depth.

It is an interesting fact to know that ulcers of the cornea, whatever may be their form or extent, are susceptible of *cicatrizalio*n. Frequently, after they have existed for a while, their progress seems to be suddenly arrested ; the eye becomes less irritable ; granulations appear ; and the excavation is thus gradually filled up, the new texture assuming at length the properties of the lost substance. Most generally, however, the reproduction is imperfect, — the cicatrice which is left being opaque, and depressed in the centre.

The lymph effused in inflammation sometimes remains unabsorbed, and gives rise to *opacity*. This occurs in every intermediate degree, from a slight haziness to entire loss of transparency, and may be either superficial or deep-seated, circumscribed or diffuse, punctiform or linear, circular or crescentic. In many cases, the opacity continues through life, the lymph upon which it depends becoming organized and thoroughly incorporated with the pre-existing tissues.

The cornea is liable to *ossification*. Wardrop saw a case in which the whole eye had changed its form, and the cornea contained a hard, smooth, oval plate of bone, weighing two grains. A piece of bone was also found between the choroid coat and the retina of the same eye.\* In another case, referred to by Voigtel, a German author,† a piece of cornea, taken from a man sixty

\* Morbid Anatomy of the Eye, vol. i., p. 74. Second edition. London, 1834.

† Handbuch der Pathologischen Anatomie, b. ii., p. 92. Halle, 1804.

years of age, was converted into osseous matter. It was three lines long, two broad, and weighed two grains. A still more remarkable example is reported by Dr. Monet, in the *Nouvelle Bibliothèque Médicale*, for May, 1817. It occurred in an old man, and the cornea is said to have been ossified throughout. This transformation is by no means so frequent as the cartilaginous, of which a considerable number of instances are related by authors.

*Fleshy excrescences* have been seen on the cornea. They are occasionally of a fungous character, and in several instances they have been found to contain hairs. These morbid growths appear to have their origin, for the most part, on the conjunctival covering of the cornea.

Alterations in the *form* of the cornea occur under two principal varieties, the conical and the spherical, which, as they arise from different causes, require to be considered separately. The conical variety (Fig. 112) is sometimes congenital, or begins soon after birth; more commonly, however, it does not come on until about the age of puberty. It is said to be more frequent in females than in males,—for what reason is not known. The alteration generally advances slowly, and occasionally affects both eyes, though seldom in an equal degree. The cornea, which is at first only somewhat prominent, gradually assumes the conical shape, and has a peculiar sparkling, crystalline appearance, preventing the pupil and iris from being distinctly seen. After a while, small whitish specks are observed, which sometimes coalesce until the whole structure is rendered perfectly opaque. In some instances, ulceration sets in, and is eventually succeeded by a protrusion of the iris. The most extraordinary example of this variety of the disease is mentioned by a German author of the name of Brugman. He declares that both corneæ were so prodigiously elongated that they reached down to the mouth like two horns!\* Both in this and in the next variety, the surface of the staphylomatous protrusion displays arborescent vessels, conveying red blood, and, where the tumor is large, acquires a cuticular incrustation.

In the other variety, which is the most common, and which usually follows the bursting of an abscess or ulceration, the cornea forms a whitish, pearl-colored projection, of a spherical figure, and often of considerable magnitude. The membrane is unequally thickened; its laminar arrangement destroyed; its texture generally more or less softened; and numerous vessels can be seen towards its circumference, and sometimes even towards its centre. In this variety the anterior chamber of the eye is annihilated; the iris is torn into radiated fragments; and vision is lost or impaired, according to the extent of the projection and the opacity of the membrane. (Fig. 113.)

Dupuytren, a few years ago, described what he calls an *encysted tumor* of the cornea. He observed it in a child who had been struck on the eye a few weeks before with a stone. It grew between the lamellæ of the membrane, and was distended with a serous fluid, which was reproduced in a fortnight after it had been evacuated. This, I believe, is a solitary instance of such a tumor in such a situation.

Fig. 112.

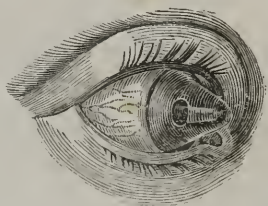
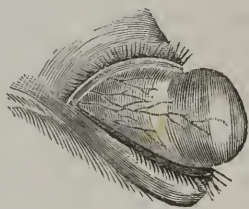


Fig. 113.



\* See Wardrop, *Op. cit.*, p. 136.

The *sclerotic coat* is a strong, dense membrane, belonging to the same class of textures as the pericardium, the periosteum, and the dura mater. It is opaque, of a dull whitish tint, consists of a single lamella, and is composed of firm, inelastic filaments so intimately interwoven as to render it impossible to unravel them. Behind, it is perforated by the optic nerve; in front, it has a large opening, which is occupied by the cornea. Externally it is convex, and covered with fine, cellular tissue, which connects it with the conjunctiva: its internal surface is smooth, glistening, and lies in apposition with the choroid.

The sclerotic coat has no sensibility in its natural state, and no nerves have been traced into it. The vessels which it receives are also few in number. A little behind the cornea it is pierced by the anterior ciliary arteries; and the posterior ciliary vessels pass through it, around the entrance of the optic nerve. The veins which form the vasa vorticosa of the choroid perforate it obliquely, about its middle.

The sclerotic coat, like the other fibrous textures, takes on inflammatory action with great reluctance; but, after having once set in, it is always obstinate, painful, and difficult of cure. The disease is generally confined to the anterior half of the membrane, is very apt to involve other parts of the eye, especially the conjunctiva, the cornea, and the iris, and is most frequently observed in persons of a gouty and rheumatic predisposition, its favorite period of attack being the spring. It is characterized by deep-seated redness of the eyeball, verging upon lilac, unaccompanied with thickening or opacity. The distended vessels form a beautiful zone about a line behind the cornea, whence they proceed backwards in a radiating direction, until they gradually lose themselves in the posterior part of the organ: they do not branch out like those of the conjunctiva, nor are they so movable under the folds of this membrane, — a circumstance which, together with the dull, aching, paroxysmal nature of the pain, may be considered as almost diagnostic of the disease. Coagulating lymph is rarely poured out by the sclerotic coat when inflamed, and it seldom, perhaps never, suppurates. In chronic cases, the redness is considerably diminished, the affected part is rendered preternaturally flaccid, and the whole eyeball assumes a sickly yellow hue.

The sclerotic coat is sometimes remarkably thin and flaccid, so as to be incapable of maintaining the globular shape of the eye. This state is usually connected with disease of the other membranes, and with disorganization of the vitreous humor. On the other hand, the sclerotic coat is sometimes unnaturally indurated and thickened; in a few instances it has even been found partially ossified. It occasionally becomes attenuated by interstitial absorption, and bulges out in the form of a staphylomatous protrusion. Wardrop mentions a case in which there were several little tumors of this kind, which felt soft to the touch, and were of a dark bluish color. Scarpa states that he once met with such a protrusion that was as large as a small nut; it was situated on the temporal side of the entrance of the optic nerve, and was of an oblong shape, the sclerotic coat being so thin at that part as to admit the light.

The *choroid coat* may be considered as a cellulo-vascular membrane, as it is essentially composed of arteries and veins, connected together by extremely delicate cellular substance. Nerves are also plentifully distributed upon this tunic; and its principal office appears to be that of secreting the black pigment which lies so abundantly upon its inner surface. Judging from its delicate organization, it might be inferred that the morbid changes of the choroid were extremely numerous and frequent, whereas quite the reverse is the case. The most important lesions to which it is subject are inflammation, dropsy, and ossification.



In inflammation of the choroid, there is little external redness, and the enlarged vessels which appear on the white of the eye are deep-seated, corresponding to the posterior ciliary arteries. When the disease is violent, suppuration may take place; and not unfrequently there is an absorption of the black pigment, or this substance is deposited in an altered and imperfect manner, or variously changed in color. The membrane is sometimes broken down in its texture, and its inner surface has been found coated with flakes of lymph. Varicose enlargement of the vessels occasionally attends this complaint; but this is a rare occurrence, and is seen only in cases of long standing. The disease is most commonly met with in strong, plethoric persons, is characterized by great intolerance of light, a contracted state of the pupil, and deep-seated pain darting through the head and temple.

Portal states that he has found hydatids between the choroid and retina; and accumulations of water have been noticed in the same situation by Zinn, Ware, Wardrop, and other writers. The fluid is generally thin and glairy, like the white of egg; but sometimes it is watery, or of a pulaceous consistence.

Ossification of the choroid has been observed by Haller, Morgagni, Bichat, Scarpa, and other writers; the occurrence, however, is quite rare, and has hitherto been witnessed only in persons far advanced in life. Though for the most part partial, the transformation sometimes affects the whole membrane, converting it into a thin, osseous cup, perforated behind for the passage of the optic nerve. The disease has been supposed by some to have its seat in the membrane of Jacob, — an opinion which I am inclined to adopt from the fact that this tunic is of a serous texture, which we know to be liable to this sort of transformation in almost every part of the body.

The *retina*, the most internal of the concentric tunics of the eye, lies between the vitreous humor and the membrane of Jacob, and is generally regarded by anatomists merely as the expansion of the optic nerve. Two distinct layers seem to enter into its composition, one of which, the external, is a very soft medullary looking texture, of the consistence of mucus, whereas the other forms a delicate vascular network, being made up mainly of vessels, derived from the central artery of the retina. In the living subject, this membrane is perfectly transparent, but soon after death, generally in the course of ten or twelve hours, it becomes pale and opaque.

Observations are still wanting to enable us to give a complete history of the morbid anatomy of the retina. That this membrane is liable to inflammation cannot be doubted; but, as to the changes which it undergoes when thus affected, nothing satisfactory whatever is known. Wardrop informs us that he once saw it of a buffy color, produced, as he supposes, by an effusion of albumen; in another case he found it quite opaque, tough, and thickened. Morgagni, Walter, and Magendie have witnessed similar examples. The latter writer relates an instance where the retina was converted into a white, firm, fibrous structure, in every respect analogous to an aponeurosis. Cases occur in which this membrane is partially atrophied, or even completely wasted, as in persons who have long been affected with amaurosis.

In *amaurosis* it not unfrequently happens that the vessels of the retina become enlarged and varicose. This change, as has been remarked by Mr. Wardrop, very probably takes place in those cases of the disease which are dependent upon cephalic congestion, and which are characterized by figures of various forms floating before the eyes. The disease may sometimes be relieved by depletion; but, in the generality of cases, there is reason to believe that it remains permanent and irremediable. Amaurosis, it may be here stated, often depends upon a deranged condition of the chylipoietic viscera, by correcting which the patient speedily recovers his sight; in other cases, it is owing

to disease of the optic nerve, or even of the brain; in others, it seems to arise from a palsied and disorganized state of the retina itself.

The *optic nerves* are liable to become diseased. In persons who have been long blind, it is not uncommon to find them very much wasted, altered in color, and changed in consistence, being either firm and fragile, or soft and pulpy. In some instances, the optic nerves are flattened, like pieces of tape, and of a yellowish, cineritious, or brownish hue. Occasionally they are the seat of calcareous concretions, of fibrous tumors, and of hydatids, though these affections are extremely rare, and I have never met with them.

There is a very singular structure, called the *membrane of Demours*, which furnishes the aqueous humor. It is extremely delicate, polished and transparent, and lines not only the posterior surface of the cornea, but the whole of the iris, terminating finally, as is supposed, on the capsule of the crystalline lens. No vessels can be seen in it in the natural state, and many anatomists have altogether denied its existence. Like the serous tissue, which it closely resembles, the membrane of Demours is subject to particular morbid changes, a bare enumeration of which must suffice for our present purpose.

When this membrane is inflamed, constituting what has been termed *aquocapsulitis*, it becomes more or less opaque, and its free surface is covered with globules of lymph, some of which are frequently detached, and float about in the anterior chamber, or form adhesions with the iris. The aqueous humor is at the same time rendered turbid, and is secreted in such abundance as to give the eyeball an unusual degree of prominence. Besides these phenomena, the posterior surface of the cornea often presents several milk-like specks, environed by a sort of disk. The specks in question give the membrane a singularly mottled appearance, and may be regarded as the characteristic marks of the disease. No capillary injection is noticed in this ophthalmia, though the vessels of the surrounding parts are often very much distended, especially those of the sclerotic coat, which sometimes form a beautiful zone just behind the cornea. Pus is occasionally poured out, but this is rare.

The lymph that is effused in this disease varies considerably in quantity. When there is only a little, it is generally absorbed; in opposite cases, it frequently remains, and gradually becomes organized, red vessels passing through it in different directions. The form of the pupil is often remarkably altered by this substance, sometimes entirely closed up by it. The membrane of Demours is occasionally ossified; and, in a few rare instances, small pieces of bone have been found in the anterior chamber.

The *aqueous humor* — the product of the membrane, the diseases of which have just been sketched — is sometimes altered, either in quantity or in quality. The fluid in the healthy eye does not exceed five drops; in old people, it is considerably less; and, in certain diseases, it is so much augmented as to constitute a real dropsy. The aqueous humor is sometimes quite acrid. Prochaska mentions a case in which it tarnished the extracting knife. The cellular hydatid has been repeatedly found in this fluid. Dr. Mackenzie gives not less than three cases of this kind, one of which came under his own observation.\* In the horse, especially in India, it is sometimes inhabited by a worm, which, in size and color, resembles the common ascaris. The animal, which has received the name of *filaria papillosa*, is about an inch long, of a greyish color, equal in size to a sewing-thread. This small insect has also been found in the ox, the buffalo, the hare, and the hadock.† It is seldom met with in birds.

The effusion of blood into the chambers of the eye from mechanical injury,

\* Practical Treatise on the Diseases of the Eye. Second edition. London, 1835.

† Dr. Tradeau, Philad. Med. Exam., iv., p. 405; Lawrence on the Eye, p. 686.

is sufficiently common ; but its spontaneous occurrence in persons in other respects well, although sometimes observed, is extremely rare. The lesion is technically denominated *hæmophthalmus*. In some rare instances, the effusion seems to be vicarious of the menstrual function. Professor Walther, the celebrated German oculist, saw a case of this kind, in which the affection recurred regularly at the monthly period, and supplied the place of the suspended menses. An example, in some respects analogous, occurred some years ago in one of the Parisian hospitals, and is detailed in the fifth volume of the London Medical Gazette. In whatever manner this apoplexy be induced, it generally disappears completely in from two to eight days, leaving the chambers of the eye perfectly clear, and vision unimpaired.

The *iris* is a thin, flat circular membrane, situated in the interior of the eye, between the cornea and crystalline lens. Its external circumference is encased in the ciliary ligament, directly over against the margin of the sclerotic coat : the internal, which is free, is a little thinner than the other, and forms the border of the rounded aperture, denominated the pupil. Both surfaces of the membrane are flat ; the anterior has a downy, flocculent aspect, and is marked by a great number of striated lines : the posterior is contiguous to the ciliary processes, and besmeared with a dark bluish pigment, similar to that which covers the choroid. When this substance is washed away, two sets of fibres may be observed, one being radiated, the other circular, the latter being placed around the pupil like a real sphincter. These fibres are supposed to be muscular ; and they are lined, as was before intimated, by a reflection of the membrane of Demours.

The iris is abundantly supplied with vessels and nerves, the former being derived from the ophthalmic artery, the latter from the lenticular ganglion. The vessels approach the membrane in four different directions, and anastomosing freely with each other, form two beautiful vascular circles, one around the outer, the other around the inner margin of the iris. The veins pursue nearly the same course as the arteries, and terminate, for the most part, in the vorticose veins of the choroid.

One of the most striking phenomena of *acute iritis*, is the vascular zone around the anterior margin of the sclerotic coat, formed by the minute ramifications of the ciliary arteries. This zone, which is not always complete, varies in distinctness, according to the intensity and duration of the disease. The vessels composing it seem to terminate abruptly at the circumference of the cornea, very few of them extending forward over its anterior surface or into its substance. The iris itself is discolored, dull, and thickened ; the aqueous humor is more or less turbid ; and the pupil is contracted, motionless, and irregular. Very frequently, perhaps most generally, the anterior surface of the iris is corrugated, slightly bulging, and covered with globules of lymph, of a whitish, yellowish, or reddish hue. Vessels and spots of blood are sometimes seen upon it ; and, occasionally, especially in the more aggravated forms of the disease, the whole membrane has a brick-colored, ecchymosed appearance. Minute abscesses also sometimes form, break, and discharge their contents into the anterior chamber. The quantity of effused lymph is often considerable, and either floats about in the aqueous humor, adheres to the surfaces of the iris, or fills up the pupil, and ties it firmly to the capsule of the crystalline lens. Great intolerance of light, deep-seated pain, lachrymation, and more or less constitutional disturbance are the ordinary attendants on this disease. Permanent adhesion of the iris to the lens, and lesion of the internal structures of the eye, are among the dangers which occur if the inflammation be permitted to progress.

There is a very slow, insidious form of iritis, which may be said to be



*chronic* almost from the beginning. There is commonly very little redness, and the patient complains chiefly of dimness of vision, which is so gradually impaired, that the sight is lost before he is aware of his misfortune. The most remarkable anatomical feature is the change of color of the iris, which is almost always of a singularly greenish cast; the membrane is also thickened, rough, and puckered, and the pupil is irregularly contracted, and fringed with lymph. The aqueous humor retains, for the most part, its natural aspect: there is little pain or intolerance of light; and the other structures of the eye are little or not at all affected. This form of iritis is generally present when the membrane protrudes from ulceration of the cornea.

*Prolapsion* produces a slow change in the texture of the iris, rendering it unnaturally hard, and changing its form: a complete adhesion is often established between it and the cornea: in many cases it is incrustated with partially organized lymph; and occasionally it assumes a granular appearance, and resembles a piece of flesh. Small tumors, of the nature of polypes, are sometimes found on the iris: they seldom acquire a large size, and are generally exceedingly vascular, bleeding on the slightest external injury, or even without any assignable cause.

The *pupil* is liable to various alterations, either congenital or acquired. Thus it has been found to be oval, rectangular, indented, slit-like, and even double; what is more remarkable, however, than all, is, that these malformations are sometimes hereditary. Children are occasionally born without a pupil. This arises from the persistence usually of the pupillary membrane, which has been known to continue until the tenth, fifteenth, and even thirtieth year of age. The changes produced by disease have been already incidentally noticed, and need not therefore be re-enumerated.

The *capsule* of the crystalline lens is of a serous nature, belonging to the same class of membranes as the pleura and peritonæum. It probably consists of a single lamella, the anterior segment of which is much thicker, denser, and stronger than the posterior. No nerves have been traced into its substance, and the only vessels that can be seen in it are a few small twigs from the central artery of the retina.

The first change produced in the capsule of the lens by inflammation, is a loss of transparency, arising from too great a fulness of its serous vessels. These vessels are arranged in the form of a wreath, composed of several distinct arches, situated about a fourth of a line from the pupillary margin of the iris. Running backwards from this wreath, in different directions, are numerous hair-like branches, which gradually lose themselves at the circumference of the lens, in the iris, and in the ciliary processes. From its excessive delicacy, this vascular arrangement can seldom be discerned without the aid of a magnifying-glass; and, occasionally, there is reason to believe that it is altogether wanting. Accompanying this injected state of the membrane is an effusion of lymph, which has always a tendency, when the disease involves the anterior hemisphere of the capsules, to produce adhesions between it and the iris. At other times, the fluid is poured out in the form of small flakes, which float about in the chambers of the eye, where they are either gradually absorbed, or become attached to the surrounding parts. Occasionally the lymph connects itself at each side with the edge of the pupil, and shoots forward like a thin, narrow bar, which, in cases of long standing, has been known to have a cartilaginous, or even an osseous consistence. In regard to the membrane itself, its texture is always remarkably altered, becoming thick, tough, and of a white, opaque, milky appearance. Similar changes occur when the disease attacks the posterior segment, with the addition of much greater vascularity.

The inflammation of this membrane always observes a chronic course. It proceeds very slowly, and is attended with little or no pain. It is most common about the age of forty, and usually attacks subjects of a cachectic disposition, with light eyes. The iris, of a darker color than natural, is sluggish in its motions, and the pupil is contracted, irregular, and encircled by a black, narrow rim. When the disease has continued for a long time, the vessels of the capsule are apt to become permanently varicose. Pus sometimes forms, and cases occur in which the enclosed lens is completely dissolved.

Opacity of this structure forms a species of cataract, denominated *capsular*, a disease which is often congenital. As already hinted, it may affect either a part or the whole of the membrane; but in the majority of instances, it is restricted to the anterior segment. The color of the cataract is very various. Sometimes it is of a dull milky appearance; sometimes white and glistening; sometimes mottled, greyish, yellowish, or brownish. Its texture also is very various, being at one time soft and pulpy, at another brittle and easily ruptured, at another tough and elastic, or of the thickness and consistence almost of the cornea. In people advanced in life, the capsule is sometimes ossified, either in part, or through its whole extent.

In the natural state, there is always found between the capsule and the lens a minute quantity of thin, pellucid fluid, which is called the *liquor of Morgagni*, from the illustrious anatomist who first detected it. This fluid occasionally becomes opaque, and thereby constitutes a species of cataract. It is also the seat, in some rare instances, of a species of threadworm, the *ocular filaria* of Nordmann.\* In one of the cases narrated by this writer, the animal was three-quarters of a line long, extremely narrow, and of uniform thickness, like the most slender thread. It was spirally convoluted, and had a simple intestinal tube, with a mouth, a uterus, and a prominent anal aperture. In another patient, an old female, Dr. Nordmann found the eye occupied with microscopical entozoa, possessing distinct suckers, and appertaining to the monostomatic genus of Rudolphi. The individuals, which were eight in number, were situated in the upper strata of the crystalline lens, were one-tenth of a line in length, and moved sluggishly on being placed in tepid water. The substance of the lens was still soft, and retained a considerable degree of transparency.

The *crystalline lens*, situated at the junction of the anterior with the posterior two-thirds of the eye, is embedded in a depression in front of the vitreous humor, being placed immediately behind the pupil, and surrounded by the ciliary processes. It is a double convex body, but the convexity is considerably greater behind than before: its diameter is about the third of an inch, and its thickness about two lines and a half. The shape, color, and consistence of the lens vary considerably in the different periods of life. In the fœtus, it is nearly spherical, reddish, and very soft: in the adult, it is transparent, firm, and strictly lenticular; and, in old age, it becomes partially flattened, augments in density, but diminishes in bulk, and assumes a yellowish amber hue.

The substance of the lens is apparently of a homogeneous character, being soft and pulpy outwardly, but dense and firm within. It is composed of a series of concentric lamellæ, six or more in number, which are disposed similarly to the coats of an onion, and united together by fine cellular tissue, the whole being moistened by an interstitial serous fluid. No nerves or vessels have yet been traced into the substance of the lens; on which account some

\* Mikrographische Beiträge zur Naturgeschichte der Wirbellosen Thiere: Erstes Hft., p. 11-13.

have imagined that it is not an organized structure. The very fact that it is susceptible of disease, is a sufficient refutation of this opinion.

It is doubtful whether the crystalline lens is susceptible of acute inflammation; but that it is often affected chronically is abundantly established by the changes which it undergoes in its color, its shape, and its consistence. These changes generally occur slowly; and, taken together, they constitute what is termed *lenticular cataract*. Existing either singly, or, as is more frequently the case, in combination with an altered condition of the investing membrane, lenticular cataract has been observed at all ages, but is most common, by far, in young children and in old persons. Infants are often born with it, and in many cases it is hereditary. Wardrop knew a father, son, and grandfather affected with it; and examples of a similar nature are recorded by different authors. Janson saw a whole family, consisting of six members, blind from this disease. A similar case is mentioned by Professor Drake.

Age exerts a powerful influence in the production of cataract. The observations of Fabini and Maunoir clearly prove that the period of life most liable to this affection is between the sixtieth and seventieth years. In five hundred cases observed by the former, fourteen occurred between one and ten years, sixteen between eleven and twenty, eighteen between twenty-one and thirty, eighteen between thirty-one and forty, fifty-one between forty-one and fifty, one hundred and two between fifty-one and sixty, one hundred and seventy-two between sixty-one and seventy, and one hundred and nine after the latter period. In one hundred and twelve cases witnessed by Dr. Maunoir, eight occurred in persons under forty years of age, eleven between forty and forty-nine, twenty-five between fifty and fifty-nine, forty-one between sixty and sixty-nine, and twenty-seven between seventy and eighty-two.\* Thus it would seem that more people are affected with cataract between the ages of sixty and seventy than at any other period of life. Children suffer comparatively seldom, though more frequently, perhaps, than youth. Sex does not appear to exert any particular influence in the production of this disease; but the male is certainly much oftener affected than the female, owing chiefly, if not wholly, to the former being more liable to all kinds of exposure.

This disease, as was previously intimated, generally proceeds slowly, so that vision is not destroyed for several years. Occasionally, however, the reverse obtains, the patient becoming blind in a very short time. Richter relates seven cases where people laboring under retrocedent gout were entirely deprived of their sight in a single night, from the formation of a cataract; and Wardrop observed several instances where this occurred in a few hours. The disease may go on simultaneously in both eyes, but generally it begins in one, and in time attacks the other. Both sexes are equally subject to it. The starting point of the opacity is usually the centre of the lens, from whence it gradually extends towards its circumference.

The consistence of a lens in a state of opacity may be natural, augmented, or diminished. An increase of consistence is most common in persons advanced in life. After the sixtieth year, and occasionally even before that period, the cataract is frequently so hard that it cannot be divided by the needle; and cases are not wanting in which it is completely ossified. A natural consistence is of rare occurrence, and is seldom seen except in young subjects, or in persons in whom the disease forms with extraordinary rapidity. A diminution of consistence is most common in childhood, and is sometimes very con-

\* Essai sur Quelques Points de l'Histoire de la Cataracte. Par Th. Maunoir, M.D. (Név.) Mémoires de la Société Médicale d'Observation, t. i, p. 70. Paris, 1837.



siderable, the lens being reduced to a thin milky fluid, or to a substance resembling half-boiled glue, arrow-root, or soft-curd.

The color of a cataract is extremely various. In children, the opacity is generally white, like milk; in older subjects, it is often of the hue of isinglass, a solution of starch, or a half-boiled egg; in aged persons, still darker, of a yellowish amber color, greyish, or brownish. A mottled appearance is not uncommon; and, in some cases, though this is rare, the lens presents a radiated arrangement, the opaque lines converging towards the centre of the affected organ. It is important to remark that a diseased lens is seldom of the same color in the eye than it is out of it.

A change of form is of rare occurrence, and cannot be regarded as a necessary consequence of opacity. The volume of the affected lens may be natural, increased, or diminished. An augmentation of size is seldom observed, and then chiefly in cases of soft cataract. Atrophy of the lens is very common in old people, and often takes place without any accompanying opacity.

The *vitreous humor* is surrounded by the hyaloid membrane, and lodged in appropriate cells formed by prolongations from its inner surface. Perfectly pellucid, it is heavier and more viscid than water, and is penetrated by a branch of the central artery of the retina. When evacuated, it is never reproduced. The changes which this fluid undergoes have not been much studied, and we know therefore very little about them. It is sometimes unusually thick or thin, increased or diminished in quantity, and more or less altered in color. The capsule itself, being of the same structure as the membrane of the aqueous humor, is liable to the same morbid states. These, however, have not been observed with sufficient accuracy to admit of description. The membrane has been found ossified. Wardrop mentions several examples of the kind, and others are related by Morgagni and Scarpa.

We have thus taken the eye apart, as it were, and analyzed the diseases of its different structures. Considered as a whole, it is sometimes affected with atrophy, and the seat of various malignant growths. Of these, the most frequent and interesting are encephaloid and melanosis.

*Encephaloid* is a very common and fatal disease, which, although most frequent in children, is by no means confined to them. I have noticed it repeatedly in adults; and seven years ago I saw my colleague, Professor Drake, extirpate an encephaloid eye from a lady, forty-two years of age. In this case, as in many others, the disease was evidently excited by external violence. For a while, it grew very slowly; but, on reaching the sclerotica, it advanced with great rapidity, so as to acquire, in a few months, a very considerable magnitude. In October, 1837, when the patient was admitted into the Cincinnati Hospital, the eye was of cylindrical shape, ulcerated, and of a dark, livid color, being the seat of repeated hemorrhages. It projected at least an inch and a half beyond the lids, but could still be moved by its own muscles, and did not appear to be attached to the socket. Her general health was rather infirm. In this condition, the organ was removed; and, on dissection, I observed the following appearances: the entire mass, after being divested of the muscles and cellulo-adipous tissue of the orbit, all of which were quite healthy, was nearly three inches in length by five and a quarter in circumference, its weight being a little upwards of two ounces. The eye itself was of the ordinary form and volume, but was considerably thrown out of its position by the morbid growth, which was of an irregularly oval shape, and sprung from the inner side of the sclerotica, near its junction with the cornea. This connection, however, was rather apparent than real; for, on tracing the heterologous mass, it became evident that it originated in the retina, which had

itself almost disappeared. The anterior surface was closely invested by the conjunctiva, which had a rough, fleecy aspect, from the morbid enlargement of its villousities: about its centre was an incrustated ulcer, about three-fourths of an inch in diameter, around which the parts were somewhat knobby, and of a bluish livid color. On cutting through this portion of the tumor, it was found to consist essentially of vessels, some of which had been opened by the erosive process, and formed the source of the frequent hemorrhages with which the patient had been latterly affected. Posteriorly the mass was of a much lighter complexion, as well as more soft, and exhibited that peculiar tubercloid arrangement so characteristic of encephaloid.

The cornea, although still transparent, was considerably diminished in size, and adhered firmly to the iris. The sclerotica was of the natural thickness, extensively attached to the choroid, and of a yellowish buff color. The choroid itself was of a speckled, brownish appearance; at some points, it was completely disorganized; and, at one part, nearly opposite the morbid growth, there was a thin, black layer of blood beneath it. The retina, as before stated, was almost entirely destroyed; and, in place of the vitreous humor, there was a dense, solid, whitish mass, evidently the result of an effusion of fibrin. The anterior chamber of the eye was obliterated, and the iris transformed into a substance resembling fibro-cartilage. The optic nerve, near its entrance into the sclerotica, was slightly enlarged, bulbous, and pervaded by encephaloid matter.

In this case, I have no doubt the retina was the primary seat of the disease, and such, if we may credit the assertion of Scarpa, Saunders, Panizza, Wardrop, Lawrence, and others, is probably the fact in almost every instance. In this respect, therefore, the above dissection is one of much interest. The case is also important in another point of view, as it shows that this terrible disease may occur after the meridian of life, and in consequence of external injury. The rapidity with which it runs its course varies from a few months to several years: when extirpated, it *invariably* returns.

In regard to *melanosis* of the eye, I have no personal experience, but it would appear, from the dissections of Burns, Wardrop, Wilson, and others, that the disease generally originates deep in the organ; and that, if it do not commence in the retina, it is closely connected with it. The optic nerve is frequently implicated, which is another proof that the heterologous growth may arise in the manner here stated. In a case recorded by Mr. Allan Burns, the cord within the cranium was as thick as the little finger, and as black as ink. The disease usually coexists with the same affection in other parts of the body, and has hitherto been noticed principally in persons above the middle age. Like encephaloid, it gradually involves all the textures entering into the formation of the eyeball, finally protrudes, and terminates in destructive ulceration.

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## CHAPTER XIII.

### OF THE EAR.

Preliminary Remarks. — Malformations of the external Ear. — Polypous Growths. — Lesions of the Tympanum. — Bones of the Ear. — Eustachian Tube. — The Labyrinth and Vestibule. — Diseases of the Auditory Nerve.

THE organ of hearing, situated partly within and partly on the outside of the

skull, is usually divided into three portions—the external ear, the tympanum, and the labyrinth, which differ from each other widely, both as respects their structure, and the arrangements of their component parts. Almost every variety of tissue enters into the formation of this complicated apparatus; and hence its diseases are not only frequent in their occurrence, but also proportionably diversified in their nature. Much, however, as has been written concerning acoustic disorders, very little, it must be confessed, is known of their anatomical characters. This is surprising, when we reflect upon the complicated structure of the auditory apparatus, the fact that many of its component parts are wholly out of the reach of ocular inspection, and the rare opportunities afforded for dissecting the organ in a state of derangement. All these are serious obstacles in the way of improvement, and we can therefore, in the present state of our knowledge, attempt little in respect to a scientific classification.

The *external ear*, embracing the auricle and auditory tube, affords a subject for pathological consideration chiefly on account of congenital malformation and polypous growths. The former of these is usually comprehended under the title of imperforation of the ear. It consists in the development of a membrane, varying in extent and thickness, and either simple, or more or less complicated, with deficiency of the auricle and auditory canal. The commonest form in which it is presented is that of a single skin-like membrane, with a central indentation, corresponding with the entrance of the natural orifice: the depth at which the septum is situated is from half a line to the third of an inch: occasionally, indeed, it lies almost in contact with the tympanum. In more complicated cases, there is not only such a structure as that here mentioned, but there is great malformation of the outer ear generally.

Sometimes the external ear is entirely wanting. The malformation is usually confined to one side, and is almost constantly connected with defective organization of the auditory passage. The hearing is not always lost when this state of parts exists. Oberteuffer has recorded an example of total absence of the auricles in an adult, who yet enjoyed this function very well. Professor Mussey, of Cincinnati, has published the particulars of a somewhat similar case, in the *American Journal of the Medical Sciences* for February, 1832. Another deviation from the normal standard is the congenital absence of the lobule of the ear, or its adhesion to the skin of the head. An anomaly of an opposite character is the enormous development of these parts.

The auditory canal, as before stated, is sometimes imperforate: at other times it is very much diminished, and occasionally it is closed up by a dense, gristly substance, possessing all the properties of fibro-cartilage. Contraction of the canal may depend upon malformation of the temporal bone, or upon thickening of the soft parts, particularly the cuticle. Deviations in regard to the direction of this passage are now and then observed; but this is extremely rare, and seldom exists singly. Sometimes its orifice is a mere slit instead of a round opening, and instances occasionally occur in which it is seriously encroached upon by the tragus, antitragus, and anthelix.

The lining membrane of the auditory tube is sometimes the seat of *polypes*. Soft and spongy in their consistence, they are of a pale reddish color, possess little sensibility, are very prone to bleed when injured, and seem to consist principally of a congeries of blood-vessels, connected by loose, cellular tissue, and enclosed by a thin delicate epithelium. They are generally of a conical shape, their attachment being by a narrow peduncle, whilst the body fills up the auditory passage, and sometimes projects a considerable distance beyond



its orifice. Occasionally there are several such excrescences; and, in some instances, they have been known to be of the form, color, and consistence of a mulberry. Their progress is slow, and they may exist for a long time without destroying the function of the ear. When connected, as they often are, with the tympanic membrane, they are apt to produce permanent deafness. The exposed parts are commonly indurated, and of a whitish color, from the influence of the atmosphere. Polypous growths of the ear are always attended with an increase of the natural secretion, which is often fetid and acrimonious.

The *tympanum*, familiarly called the drum of the ear, is lodged in the base of the petrous portion of the temporal bone, being interposed between the auditory tube, and the labyrinth, on which account it is not unusual for anatomists to speak of it as the middle ear. It is a narrow, irregularly cylindrical cavity, about three lines in length, and from five to six in breadth. Posteriorly, it receives the orifice leading to the mastoid cells, and, anteriorly, the opening of the Eustachian tube, whilst across its interior is stretched a chain of bones, the most delicate in the whole body. Throughout its entire extent, it is lined by a mucous membrane.

The most important part of the middle ear, in reference to pathological anatomy, is the tympanic membrane. This membrane is of a circular shape, oblique in its direction, slightly concave externally, and proportionably convex internally. Being extremely delicate and transparent, it is made up of three lamellæ, of which the inner is merely a reflection of the mucous lining of the middle ear; whereas the outer, which is easily detached by maceration, is continuous with the cuticular covering of the auditory tube. The intermediate layer, that which gives the part its firmness and distinctive character, is of a fibrous structure, being composed of a great number of the most delicate filaments, running like radii from the periphery towards the centre, where they are fixed to the long handle of the malleus. The vessels of the tympanic membrane are unusually abundant, and they resemble, in their mode of distribution, those of the iris.

Do wounds of the tympanic membrane ever *cicatrize*? Daily observation has long since answered this question affirmatively. Nor are there experiments wanting to illustrate the subject. Valsalva repeatedly perforated, and even lacerated, this structure in dogs, which, after some time, he killed. In every one, the wounds were perfectly closed and cicatrized. Similar experiments performed by others, were followed invariably by similar results. Indeed, so fully are surgeons aware of this occurrence, that particular instruments have been devised for the purpose of preventing it. The period required for this reunion in the human subject varies from six to eighteen days, according to the size and shape of the opening, and the state of the membrane at the time of the operation.

Acute *tympanitis* is by no means unusual, and the rapidity of its course, as well as its mode of termination, is extremely variable. Generally only one ear suffers at a time, though it often happens that both are affected simultaneously. The anatomical characters are increased opacity, and thickening, with perverted secretion. In mild cases, the redness is usually very slight, and only a few straggling vessels are to be seen; but when, on the other hand, the inflammation is intense, the affected part is of a scarlet hue, and the capillaries are so numerous as to present the appearance of a beautiful network. The normal transparency also is destroyed, and the parts look swollen and protuberant. Although lymph is seldom found upon the free surfaces of the membrane, yet in very severe cases it is not uncommon for this substance to be effused into its interlamellar structure. The ceruminous secretion is frequently suppressed, but the auricle and auditory tube remain unaltered.

This disease, which may effect either a part or the whole of the membrane, sometimes terminates in *suppuration*. The matter is rarely of a healthy character; on the contrary, it is usually muco-purulent, thin, fetid, and so acrid as to erode the structures with which it comes in contact. Blood is occasionally blended with it, the result, probably, in most instances, of exhalation. If the suppurative process be allowed to pursue its course unmolested, ulceration is superadded, which often continues until the membrane is seriously injured. The part of the membrane most liable to be thus affected is that immediately around the insertion of the handle of the malleus. The number of ulcers is generally small: they are, for the most part, of an oval shape: they vary in size between that of a pin-head and a split pea; and in many instances they embrace the whole thickness of the affected part, leading to perforation and a discharge of the bones of the ear. Ulcers in this situation probably sometimes cicatrize.

In *chronic* inflammation, although the vascularity is usually much less than in the acute form, the membrane exhibits every shade of red, from a pale rose to a mahogany brown. Striking alterations in the texture of the affected part are also observed. It is opaque, uneven, and thickened, so that the concavity of the membrane is effaced, and the insertion of the malleus can no longer be recognized even in the strongest light. Minute granulations are often seen upon the inflamed surface, varying in consistence from the softness of recent lymph to the density of fibro-cartilage, and in color, from a pale ash to deep red: they are seldom bigger than a clover-seed, and are generally excessively sensitive, as well as vascular, giving rise to considerable pain, and bleeding on the slightest touch. Small openings are frequently observed; added to which there is always a muco-purulent secretion, which is often discharged in great quantities, both externally and along the Eustachian tube. The matter is sometimes excessively offensive, particularly in scrofulous subjects, and of a greenish yellow color. In other cases, it is thin and glairy, like the white of eggs, and exhales a disagreeable ammoniacal odor. When the inflammation continues very long, the tympanic membrane, provided it is not wholly destroyed, not only becomes opaque and thickened, but acquires a dense, fibro-cartilaginous consistence. Examples of this kind, indeed, are not unusual.

In severe cases of this disease, it is not uncommon for the cellular tissue and periosteum of the middle ear to become involved. A destruction of the tympanic membrane, together with a discharge of the small bones, is the usual consequence of this state. In addition to all this, there is generally extensive suppuration; the middle ear, the labyrinth, and the mastoid cells are filled with acrid pus; the petrous portion of the temporal bone is carious; the adjacent part of the dura mater is thickened, discolored, and partially detached; and the brain is softened and otherwise disordered.

*Pus*, chalky, and tubercular matter are sometimes found in the cavity of the tympanum; and Morgagni observed a case in which it was intersected by delicate membranous bands, the result, probably, of former inflammation. Itard saw it filled with thick, yellow lymph; and, in one instance, he noticed a thin, watery fluid enclosed in distinct cells. Rosenthal witnessed similar appearances in the tympanum of a deaf mute.

The little *bones* of the ear may be wanting as a congenital defect, or as the result of ulcerative action of the tympanic membrane. It is seldom that they are all absent, yet several such cases are on record. In a deaf child, three years of age, Bailly found the ossicles of only one-third of their proper size. On the other hand, Cotunnus once found them twice as large as natural; the foramen rotundum was obstructed, and the labyrinth otherwise diseased.

Communicating with the tympanum is the *Eustachian tube*, a passage leading

obliquely forwards, inwards, and downwards, to the fauces, by the mucous covering of which it is lined. It is about two inches in length, by a line and a half in diameter, and is made up of three parts,—the posterior being osseous, the middle fibro-cartilaginous, and the anterior membranous. The lesions of the Eustachian tube may be thus stated: 1, congenital imperforation; 2, acute and chronic inflammation, with induration and thickening of the lining membrane; 3, partial stricture; 4, the presence of chalky matter; 5, mucous obstructions. Similar lesions occur in the mastoid cells.

The *labyrinth* is the most intricate structure in the body. It lies between the tympanum and internal auditory hole, and consists of the vestibule, the semi-circular canals, and the cochlea. Of the diseases of these chambers very little is known; it is certain, however, that they are infrequent, and that their anatomical characters have hitherto been very little studied.

Nature may leave the structure of the labyrinth imperfect, or it may, so to speak, wholly neglect its organization. In a case mentioned by Saissy, although the ear was well formed, the essential part of the auditory apparatus was entirely absent, there being no trace whatever of the vestibule, cochlea, or semi-circular canals. The small bones, however, were present, and the cavity of the tympanum was filled with a mucilaginous fluid. The Eustachian tube exhibited nothing unusual. The labyrinth is sometimes imperfectly ossified, exposing thereby a portion of its membranous structure; and cases are observed, though they are very rare, in which it is composed of a single cavity, having no communication with the tympanum. Malformations of this kind are analogous to what naturally occurs in the organ of hearing in crustaceous animals.

The *vestibule*, as well as the rest of the labyrinth, is occasionally filled with a substance resembling cheese. Dr. Haighton and Mr. Cline, of London, each met with an interesting case of this sort, attended with congenital deafness. Itard found the vestibule occupied with calcareous matter. Duverney states that he has often seen the labyrinth filled with thick, purulent fluid. This appearance is most common in young children, and in nearly every case is connected with disease of the cavity of the tympanum.

Another malformation of this portion of the auditory apparatus is that of the round and oval apertures. These openings are not only unusually small in some instances, but even entirely wanting. The membranes closing them may also be diseased. Long-continued irritation has a tendency to render them thick, hard, and dry; and several cases are now on record in which they were completely ossified. We have already seen that the Cotunnian liquor is liable to degenerate into substances not naturally contained in the internal ear.

Of the diseases of the *auditory nerve* we are totally ignorant. That it is liable to be variously affected there can be no doubt; and that deafness, partial or complete, may be thus induced appears equally certain. The nerve is sometimes unnaturally small, soft, or hard.

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## CHAPTER XIV.

### OF THE THYMUS GLAND.

Situation, Weight, Size, Color, and Consistence. — Development and Decay. — Hypertrophy. — Thymic Asthma. — Inflammation. — Ulceration. — Scirrhous. — Tubercular Deposits. — Ossification. — Steatomatous degeneration.

THE thymus gland is situated in the anterior mediastinal cavity, being in



connection, in front, with the sternum and the sterno-hyoid and thyroid muscles ; behind, with the trachea, the pericardium, and the great vessels of the neck. Laterally, it frequently overlaps the lungs, especially the right. In the fœtus and new-born infant, it is of a light reddish color, inclining to pink, and reaches from near the diaphragm to the thyroid body ; as life advances, it assumes a yellowish tint, and gradually diminishes in bulk ; so that, about the period of puberty, there is scarcely a vestige of it. Consisting of two lobes, of which the left is often larger than the right, the gland has a sort of forked appearance, and is of an irregularly triangular shape, being considerably broader above than below. Of a soft, fleshy consistence, it is invested by a very thin, delicate capsule, which gives it a smooth, polished appearance, at the same time that it sends a multitude of thread-like processes into its interior, separating it thereby into numerous lobules. Each of these little masses, which vary in size from a millet-seed to a pea, contains several minute vesicles, which are filled with a viscid, milky fluid, analogous to that of the thyroid body, and which all open into one general cavity, called by Sir Astley Cooper\* the *reservoir* of the thymus. It extends from one extremity of the gland to the other, in a kind of spiral direction, is more capacious at the middle than above or below, and is lined by a delicate, vascular membrane, apparently of a villous nature, and presenting upon its internal surface a number of small apertures, which are merely the mouths of the excretory ducts leading from the different lobules of which the gland is composed. In the human fœtus this central cavity is constantly occupied by a white, cream-like fluid, intermixed with red globules. What its precise character is has not been ascertained ; but in the calf it would seem, from the analysis of Dr. Dowler, to consist of albumen, fibrin, mucus, and muco-extractive matter, together with muriate and phosphate of potash, phosphate of soda, and a trace of phosphoric acid. Warm water dissolves a large portion of it, and it is readily coagulated by heat, alcohol, and acids.

The arteries of the thymus are furnished by the inferior thyroid, pericardiac, and internal mammary. Its veins terminate in the thyroid and the left innominate. Several large lymphatic vessels traverse it ; and its nerves are derived from the inferior cervical ganglia, the phrenic, and pneumogastric.

The weight of the thymus at birth varies from a drachm and a half to three drachms and a half, or even four drachms, according to the size of the fœtus, and the quantity of sero-albuminous fluid contained in the cavity of the organ. By Cloquet, Haugsted, Cooper, Müller, and Horner, the average is fixed at 240 grains, or half an ounce. Meckel, who concurs in this estimate, asserts that the gland in a large fœtus, born at the full term, often weighs five drachms, or 300 grains. Dr. W. C. Roberts,† of New York, who has recently investigated this subject, states, as the result of a considerable number of examinations, that the weight of the thymus at birth ranges from 120 to 180 grains ; an estimate previously made by a writer in the London Medico-Chirurgical Review.

The size of this organ is not less variable than its weight. The following are the dimensions of eleven thymus glands, as furnished by Dr. Roberts, in the paper previously referred to.‡

\* Anatomy of the Thymus Gland, p. 30, London, 1832.

† New York Medical Gazette, April, 1842.

‡ The table of Dr. Roberts embraces altogether seventeen cases, but to render it as unexceptionable as possible, I have excluded from it all those where the child died before the full term, or not until some days or months after birth.

Number.		Length.		Breadth.		Thickness.
1	-	1 inch	-	1 inch	-	-
2	-	$1\frac{8}{10}$	-	$1\frac{8}{10}$	-	5 lines
3	-	$2\frac{2}{4}$	-	2	-	-
4	-	$2\frac{2}{4}$	-	$1\frac{8}{10}$	-	-
5	-	2	-	$2\frac{1}{3}$	-	-
6	-	$2\frac{1}{2}$	-	$2\frac{1}{2}$	-	$\frac{7}{10}$
7	-	$2\frac{1}{2}$	-	$1\frac{3}{10}$	-	-
8	-	$2\frac{1}{2}$	-	$1\frac{1}{4}$	-	-
9	-	$3\frac{1}{4}$	-	$2\frac{1}{4}$	-	-
10	-	$3\frac{3}{16}$	-	$1\frac{1}{4}$	-	-
11	-	$2\frac{3}{8}$	-	$1\frac{3}{4}$	-	-

The gland sometimes consists of two distinct lobes, connected together by a narrow isthmus; at other times it is extremely small, weighing, perhaps, scarcely a drachm, and in a few instances it has been found entirely wanting, as a congenital defect, in acephalous or anencephalous monsters.

The thymus gland is subject to very few diseases. The principal lesions requiring consideration, are atrophy and hypertrophy, together with the tubercular and carcinomatous degeneration. The organ, as was long ago remarked by Dr. Baillie, appears to be very little disposed to common inflammation; abscesses are therefore of very infrequent occurrence, and have been seldom noticed by authors.

The development and *decay* of this organ have, of late, received much attention from anatomists. It becomes visible during the third month of gestation, and continues to grow until the end of the second year of extra-uterine life. Between this period and the commencement of the second dentition, the gland remains nearly stationary in its size, undergoing, however, certain changes in its structure and consistence, by which, whatever be their nature, it is probably rendered unfit for the further performance of its functions. It is only after the evolution of the permanent teeth that the organ begins to experience any decided decrease: it now rapidly diminishes in volume; its vessels shrink; its cells are obliterated; and, as the juice by which it is moistened dries up, its substance becomes hard and shrivelled. At a still later period, the gland loses its granular structure, and no longer exhibits any traces of its lobular arrangement, — a soft, dingy, cellular tissue being all that is left, and this, in time, is wholly absorbed. The precise age at which the last traces disappear does not seem to be accurately ascertained: many highly respectable writers, as Hewson, Meckel, Hildebrandt, and Burdach, fixing it at the twelfth year, while others, amongst whom is Haugsted, maintain that it is not completely absorbed until thirty. Caldani and Sir Astley Cooper, on the contrary, assert that it never entirely disappears, but that vestiges may always be found, whatever may be the age of the individual. My own dissections lead me to the conclusion that this organ varies very greatly, in respect to its disappearance, in different persons, being atrophied very early in some, and in others not until very late. In the generality of cases, it is completely effaced between the twelfth and fifteenth years. Although the changes here described are altogether of a physiological character, there is reason to believe that they are occasionally expedited by accidental circumstances, as the pressure of an enlarged heart, a diseased lung, or an aneurismal state of the arteries at the base of the neck.

A not uncommon affection of this gland is *hypertrophy*. This disease, which has recently attracted much attention in Europe, was first accurately described

by Dr. Kopp, of Germany, under the name of *thymic asthma*, though it does not seem to have been entirely unknown to other physicians. Indeed, Richa and Verdries, who wrote more than a century ago, distinctly recognized inordinate development of the organ under consideration as a cause of asthma in children. Since the appearance of the essay of Dr. Kopp, a very able paper on the same subject has been published by Dr. Hirsch, of Königsberg, and also one by Dr. W. F. Montgomery, of Dublin, besides several others which it is not necessary to specify.\*

Thymic asthma is an affection peculiar to childhood, and consists, as already intimated, in an inordinate development of the gland of that name. It generally comes on between the fourth and tenth months, lasts from three to eight weeks, and is characterized by fits of suffocation, during which the breathing is often completely suspended, the countenance being livid, the eyes fixed, the nostrils expanded, the hands closed, and the thumbs clenched. These symptoms usually subside in a few minutes, when the infant gradually recovers its accustomed cheerfulness. The pathognomonic sign of this disease is a short, acute, hissing inspiration, alternating with a weak, croup-like expiration. It is supposed to be most common in scrofulous subjects; males are more liable to it than females; and it appears to be often associated with an open state of the foramen ovale.

The thymus gland in this disease is generally enlarged in every direction, but the most of all in thickness. The weight commonly varies from six to eight drachms. In a few rare instances, it has amounted to nearly two ounces. When very bulky, the organ compresses the lungs and trachea, inducing that peculiar train of symptoms by which the complaint under notice is characterized. Occasionally, the enlargement is so great as to conceal the heart, and obscure its pulsations. Morbid adhesions are sometimes formed between the gland and the surrounding structures; and the large veins at the base of the neck are often so much obstructed as to prevent the ready return of the blood from the brain to the heart.

The substance of the gland may be in a normal state, or variously altered in color and consistence. Occasionally, it is pale, soft, and pulpy. More commonly it is preternaturally red, and of a dense, fleshy consistence, with numerous vessels running over its surface, and penetrating into its interior. On cutting into it, a dirty milk-like fluid sometimes exudes from it.

The thymus gland is doubtless subject to common inflammation, both acute and chronic; but the disease has been so seldom observed that no one has yet attempted to point out its anatomical characters. Many cases are on record in which purulent fluid was found in its interior; but there is reason to believe that in a great majority of them, if not in all, it was the result of the softening of tubercular matter, and not of ordinary suppuration. What countenances this opinion is the fact that the pus usually coexists with tubercular disease of other parts of the body, particularly the lungs, spleen, and lymphatic ganglions, and that it is almost always of a curdy or caseous nature, similar to that of a lumbar abscess, a scrofulous joint, or a pulmonary excavation.

Ulceration of this gland has been observed in a few rare cases. In one, recorded by Mr. Wood, of Scotland, in the fifth number of the *Edinburgh Journal of Medical Science*, nearly the whole organ appeared to have been destroyed by this process.

\* Professor Lee, of New York, after a careful examination of many of the published cases of thymic asthma, has come to the conclusion that there is really no such disease, but that the affection which has been described under this name is produced by entirely different causes. His remarks, which are highly interesting, are contained in an elaborate monograph on the Thymus Gland, in the *American Journal of the Medical Sciences*, vol. *iii.*, new series.



This organ is said to be occasionally the seat of *scirrhus*. This, however, I very much doubt, for the reason, principally, that the gland generally disappears long before we attain the period of life at which the disease in question is liable to be developed. Sir Astley Cooper\* has described a case of what appeared to him a *fungoid* tumor of the thymus, in a girl nineteen years of age. The organ was of a yellowish white color, and divided into several large lobes, its reticular texture being filled with a white pulpy substance; it was much enlarged, and extended from the arch of the aorta to the lower part of the thyroid gland, which was also considerably hypertrophied. The patient was subject to frequent attacks of dyspnoea, attended with a painful sense of suffocation, and the swelling had existed for several years, but had latterly much increased in size.

Tubercles of the thymus have been noticed by a considerable number of pathologists. A very interesting case of the kind fell under my observation six or seven years ago, in a phthisical child, fifteen months old. The tubercles were of large size, and in a state of partial softening. The glandular structure immediately around them was unusually hard, and of a deep red color, from the great distention of its vessels. Tubercles, some of them in a state of suppuration, existed in immense numbers in the lungs and spleen. All the other viscera were sound. Cruveilhier† found the thymus gland of an infant that died of marasmus, at six months, double the natural volume, and full of crude and softened tubercular deposits. The lungs were perfectly healthy. In another infant, which ceased to breathe a few minutes after birth, the gland was occupied by an abscess, and was so large that it filled the whole anterior mediastinum. It was divided into cells of different sizes, and contained a considerable quantity of thick, viscid pus. The lungs were unusually voluminous, heavy, and almost impermeable to air. Haller, in his "Disputations," has related a case in which a tubercular cavity in the thymus communicated with the trachea.

The thymus has been found partially ossified. Benninger observed an instance of this kind, and others are alluded to by Haugsted, Vater, Harder, Hofmann, Schurigius, and Lieutaud, mention cases where it was enlarged, and occupied by calcareous or bony concretions. Writers also speak of the steatomatous degeneration of this organ, but of this there is probably not a well-authenticated example on record.

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## CHAPTER XV.

### OF THE THYROID GLAND.

Location and Organization. — Acute Inflammation. — Suppuration. — Goitrous Enlargement — Sanguineous Effusions. — Atrophy. — Tubercular Deposits. — Scirrhus. — Symptoms of Diseases of the Thyroid Gland.

THE thyroid gland, lying at the anterior part of the neck, extends from the inferior margin of the wings of the thyroid cartilage to the level of the third piece of the trachea. In front, it is covered by the common integuments and the sterno-hyoid and thyroid muscles; laterally by the platysma myoid, omo-

\* The Anatomy of the Thymus Gland, p. 47, London, 1832.

† Anatomie Pathologique, t. i., Livr. xv.

hyoid, and sterno-mastoid. Projecting outwards, it overlaps on each side the primitive carotid artery and the internal jugular vein, together with the pneumogastric, recurrent, and great sympathetic nerves. These relations of the thyroid gland should not be forgotten by the student of morbid anatomy, as they will enable him to account for many of the symptoms which attend excessive enlargements of this organ.

Of a dirty reddish color, the thyroid varies in size, not only in different individuals, but in the same person, at different periods of life: generally, however, it is comparatively larger in children than in adults, and in women than in men. Its average weight is about one ounce. Transversely it measures three inches and a quarter; vertically, somewhat more than two. Two lobes, united by a thin, narrow *isthmus*, compose this body; they are convex in front, concave behind, and larger below than above, where they slightly approximate each other.

Externally, the thyroid gland is invested by a very thin, delicate capsule, composed of condensed cellular substance, to which it is indebted for its smooth and polished appearance. The proper parenchyma consists of a number of small irregularly rounded lobules, of a soft, spongy texture, in which are contained many minute vesicles, filled with a colorless, or thin, oily, yellowish fluid. Some of the older anatomists, as Santorini and Schmidt Müller, supposed that they had discovered an excretory duct, by which this fluid was conveyed into the trachea; an opinion which has not been verified by any of our best modern observers. I have myself often searched for it, but have never succeeded in seeing it.

This organ is extremely vascular: it receives two arteries on each side, one from the laryngeal branch of the external carotid, and the other from the thyroid branch of the subclavian. Its veins, which are very numerous, form frequent anastomoses, and follow, for the most part, the course of the arteries. The nerves are derived from the pneumogastric and the cervical ganglia; its lymphatic vessels terminate in the neighboring glands.

There are few organs more exempt from disease than the thyroid gland. The principal affection to which it is liable, in this country and in Europe, is bronchocele, goitre, or chronic enlargement: it is likewise susceptible of acute inflammation, suppuration, scirrhus, and several kinds of degeneration. Gangrene rarely, if ever, occurs.

*Acute inflammation* of the thyroid gland may be ranked among the rarest affections. Existing occasionally as an idiopathic disease, it is generally caused by external violence, local irritants, or lesion of some contiguous structure, as the larynx, trachea, or œsophagus. The anatomical characters are very similar to those which take place in inflammation of the other organs. The gland is soft and succulent, considerably augmented in bulk, and of a dark purple hue; all its vessels being abundantly loaded with blood. Sometimes its substance is remarkably tender, yielding upon the slightest pressure of the finger; and, in a few rare instances, it is infiltrated with blood, sanies, or pus. Matter is seldom found as a consequence of acute inflammation; still more rarely is it deposited in the form of an abscess. Of this, however, I have recently seen a most interesting example, in a man forty-four years of age, who died of pneumonitis after an illness of three weeks. On inspection, Dr. Woodward and myself found the whole gland, with the exception of a small portion of its inferior extremity, converted into a thin, delicate sac, containing nearly three ounces of thick, cream-colored pus. The thyroid cartilage was completely denuded, and the matter had burrowed upwards underneath the hyoid bone on the left side, as far as the root of the tongue. The most extraordinary

circumstance in this case was, that the patient never suffered the slightest uneasiness in this part during his indisposition, and it was only by accident that the lesion was discovered on the examination.

More frequently the suppuration follows on chronic inflammation. To this description belongs the interesting case recorded by Allan Burns.\* The suppuration took place in both lobes: the matter was tardily secreted, and the integuments became gradually distended, until they formed a large pouch, which hung over the sternum, and contained several pounds of pus. By retaining the sides of the cyst in contact, adhesion was at length effected, and the woman recovered. The purulent matter, from the effect of the muscles and cervical aponeurosis, is generally slow in working its way to the surface. In some instances, as in the case mentioned by Baillie, it finds its way into the trachea, and destroys the patient by suffocation. The quantity of fluid is occasionally very great. Alibert saw a patient in the St. Louis hospital of Paris, who had an enormous bronchocele, which was eventually relieved by discharging upwards of five pounds of purulent matter.

Chronic enlargement of the thyroid gland, constituting what is called *bronchocele*, *hypertrophy*, or *goitre*, occurs at all periods of life, from infancy to old age; and is principally observed in the female sex. It is most apt to appear during the first ten or twelve years after birth; and instances are not wanting, though they are rare, where it was congenital. Of this Foderé, Sterndale, and Consbruch, have each related examples. The disease is not confined to the human subject. It has been noticed in the horse, cow, sheep, dog, and other inferior animals.

There are certain localities in different quarters of the globe in which this disease seems to be much more common than in others, — for what reason is not known. In the United States, it is often observed in the mountainous districts of Pennsylvania, Virginia, New York, New Hampshire, and Vermont: in England, it is very common in Derbyshire, Norfolk, and Surry; and, in the valleys of the Alps, Apennines, and Pyrenees, it not unfrequently prevails endemically, almost all the native inhabitants being more or less affected with it. The enlargement is often attended with a stunted development of the body; and, in certain parts of Switzerland, Savoy, Lombardy, and the Tyrol, it is apt to occur in combination with cretinism; a state characterized by great deformity of the head, and entire absence of intellect.

Hypertrophy usually begins in the form of a small tumor, on one or both sides of the trachea, which, gradually enlarging, at length occupies the whole anterior part of the neck, from the chin to the top of the breast-bone. In some instances, the swelling is of frightful magnitude, extending upwards as far as the ears, and downwards a considerable distance over the chest. In a case mentioned by Alibert, the gland, of a tapering, cylindrical shape, reached to the middle of the thighs; and other examples, not less remarkable, are related by Miltemayer. In the early stage of the disease, the substance of the tumor does not seem to be very materially altered: it is unnaturally vascular, slightly indurated, and still elastic: as the enlargement progresses, however, it becomes more and more firm, until ultimately it acquires the density of a hepatized lung, or even of fibro-cartilage. The hypertrophy, although it usually begins simultaneously in both lobes, seldom proceeds equally, and occasionally it is seated chiefly in the isthmus of the organ, the remainder being little affected.

The internal substance of the tumor is liable to considerable variety, depending upon its age and progress. When of moderate standing, it is generally of

\* Observations on the Surgical Anatomy of the Head and Neck, p. 215. 1823.



a soft, gelatinous consistence, emitting, on pressure, a ropy, glutinous fluid. In more ancient cases, it is of a pale cinnamon tint, hard to the feel, and interspersed with numerous cysts, generally not larger than a pea, containing a serous, glairy, or melicerous substance, and occasionally pus, fibrin, or even pure blood. These cysts are merely enlarged cells, which are dispersed through the organ in the natural state. Fig. 114 exhibits these cavities hypertrophied from disease, and occupied by a white, semi-concrete substance, similar to coagulated lymph. Calcareous concretions are sometimes found either alone, or in union with cartilaginous and osseous productions. In a small goiterous tumor, which I removed from a man fifty years of age, and which is now in my private collection, there are several small steatomatous masses, with a circular nodule of bone, about six lines in diameter. It is of a deep yellow color, very compact in texture, and surrounded by a thin, imperfect capsule. Occasionally the whole organ is transformed into an osseous cyst, filled with various kinds of matter, especially the jelly-like, the suety, and the meliceric. I have a specimen of this kind in my cabinet: one of the lobes has almost entirely disappeared, whilst the other is converted into a firm, solid capsule, as hard as bone, though scarcely a line in thickness. On sawing through this osseous tumor, which does not exceed the volume of a hen's egg, I found it filled with a white, curdy, friable substance, not unlike semi-concrete cheese. The annexed sketch, Fig. 115, represents a section of this tumor.

Fig. 114.

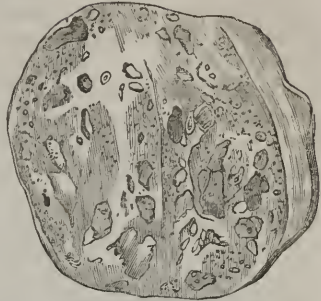
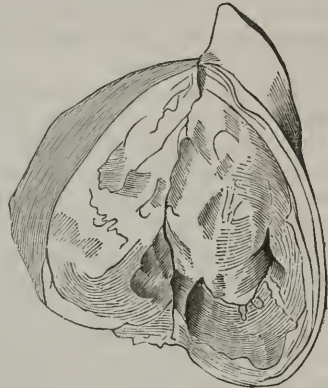


Fig. 115.



The thyroid arteries are commonly much enlarged, and, in some cases, the goiterous swelling seems to consist almost wholly of a congeries of varicose veins. Under such circumstances it is by no means unusual to meet with considerable *sanguineous effusions*, in various stages, so to speak, of maturation, — some being quite fluid, some semi-concrete, and others of a dense, firm consistence, like old apoplectic depôts of the brain. The blood is commonly poured into the enlarged vesicles, but occasionally it finds its way into the connecting cellular substance, which is, at the same time, more or less lacerated. In some instances, it may be traced directly to a ruptured vessel.

In the early stage of the disease, the skin over the affected gland is perfectly natural, both as regards its color and mobility; by and by, however, as the hypertrophy increases, it becomes dark, dense, vascular, and irregularly adherent. The enlargement is usually very slow and gradual, years often elapsing before it attains much bulk. Occasionally, the gland, after having become partially hypertrophied, remains stationary for a while, and then goes on increasing; or suppuration sets in, and the substance of the organ is absorbed; nature thus effecting a sort of spontaneous extirpation. Of this, some interesting cases are given by Petit, Hevin, and Alibert.

Of the remote causes of goitre, nothing satisfactory is known. By many it has been attributed to the use of impure water, to innutritious diet, to

the repulsion of cutaneous diseases, and a variety of similar circumstances equally hypothetical, and, for aught we know, unfounded. Concerning the proximate cause of this singular malady our knowledge is of a more positive nature. Some of the older writers supposed that it arose immediately from an obstruction of a certain number of passages which they imagined to lead from the thyroid gland to the trachea; but, as no such openings exist, the opinion must of course fall to the ground as untenable. But, even granting that there were actually such apertures of communication, and that they were liable to be blocked up in the manner alleged, still the circumstance could only be viewed in the light of an exciting, not in that of a proximate cause; which invariably consists in inflammatory irritation of the thyroid tissue, pursuing a slow, chronic march. That this is the fact, is at once indicated by the morbid alterations which this organ experiences during the progress of the enlargement, and which can only be explained on the ground which has been here assumed.

The thyroid gland is sometimes partially *atrophied*. In several instances, I have found it less than one-third the ordinary bulk, having been reduced to a soft, spongy, dirty-looking mass. The wasting, which is more common in men than in women, is observed chiefly in advanced life. The vessels supplying the atrophied gland are usually very much diminished in volume, and many of the smaller branches appear wholly obliterated. The nerves are also abnormally delicate.

*Tubercles* are rarely found in the thyroid gland; and the same remark may be made concerning *encephaloid*, so common in some of the other viscera. The organ occasionally becomes *scirrhus*; but this, too, is very rare. When thus affected, the gland seldom attains much bulk; it is of a light greyish tint, and cuts like an unripe pear, from the intersection of fibrous filaments. The cells of the thyroid are said to have been occasionally filled with *hydatids*; but this is probably an error, arising from confounding such appearances with the sero-albuminous collections so common in *goiterous* and other enlargements.

Of the *symptoms* of these different affections, little need be said in this place. Acute inflammation is commonly attended, it may be supposed, by pain, and tenderness on pressure, with more or less constitutional disturbance, especially when it passes into suppuration; yet, that these are not invariable results, appears sufficiently from the case which I have already cited of thyroid abscess, where the patient did not evince the slightest uneasiness in any part of the throat. When the quantity of matter is considerable, a pendulous tumor will gradually form in the region of the affected organ, presenting a distinct fluctuation, on the application of the finger, accompanied with hectic fever, and difficulty in breathing and swallowing. Owing to the thickness and firmness of the covering of the abscess, an early incision should always be made, otherwise its contents may work their way into the *œsophagus*, or, what is worse, into the trachea, or the larynx.

*Goiterous enlargements* are always easily recognized, their situation and history being commonly sufficient for determining their diagnosis. They prove troublesome chiefly by their mechanical pressure on the windpipe, impeding respiration, deglutition, and the return of the blood from the head. In this manner may be induced headache, giddiness, apoplexy, aphony, diseases of the heart and lungs, and, occasionally, even death.

*Scirrhus* generally occurs in advanced age, and is characterized by occasional darting pains in the region of the affected part. It may be further distinguished by its great hardness, and by the fact that it rarely attains much magnitude.

## CHAPTER XVI.

## OF THE RESPIRATORY APPARATUS.

## SECTION I.

## OF THE AIR-PASSAGES.

I. *Lesions of the Air-Passages.*—Inflammation of the Larynx.—Membranous Croup—Œdema of the Glottis—Ossification of the Laryngeal Cartilages.—Polypous Growths.—Warty Excrescences.—Tubercles and Hydatids.—Trachitis.—Stricture.—Dilatation—Inflammation of the Bronchiæ. Dilatation.—Contraction.—Flattening.—II. *Lesions of the Lungs.*—General Observations.—Structure and Functions.—Acute Inflammation.—Hepaticization.—Carnification.—Abscess.—Gangrene.—Chronic Pneumonitis.—Œdema.—Emphysema.—Apoplexy.—Encephaloid Disease.—Melanosis.—Serous Cysts.—Hydatids.—Calcareous Concretions.—Hypertrophy.—Atrophy.—Tubercular Plithisis; its History and Symptoms.—III. *Lesions of the Pleura*—General Observations on its Arrangement, Structure.—Acute Inflammation.—Formation of Matter.—Gangrene.—Chronic Pleuritis.—Ossification.—Accumulation of Gas.—Ulceration—Tubercular Deposits.—Symptoms of Pleuritis.—Position of the Patient.—Alteration of Respiratory Murmur.—Ægophony.—Dulness on Percussion.—Friction Sound.

I. THE *larynx* is liable to inflammation, œdema, abscess, ulceration, ossification of its cartilages, and polypous growths.

Preternatural vascularity, and redness of the lining membrane, either diffused or in patches, with tumefaction of the mucous follicles and the secretion of a clear limpid fluid, constitute the anatomical characters of *acute laryngitis* in its earlier stages. By degrees, the redness increases in intensity, and extends, on the one hand, down into the trachea, and, on the other, up into the fauces, affecting, in some instances, the tonsils, soft palate, and even the root of the tongue. Various are the changes observed in the epiglottis. In some cases it is thickened, infiltrated, and so erect as to leave uncovered the mouth of the larynx; in others, it is highly vascular, clotted with lymph, and studded with enlarged follicles. Within the larynx itself, the tumefaction is seldom very conspicuous, except sometimes in the ventricles; and it almost always terminates at the junction of the trachea, though, as was before mentioned, the redness often extends beyond it. In the progress of the disease, the natural secretion becomes much altered; it is no longer thin, sparse, and watery, but thick, tough, abundant, and of a yellowish tinge.

Acute laryngitis usually runs its course in from three to five days. It is characterized by high inflammatory fever, dyspnœa, cough, hoarseness, more or less pain, and expectoration of thick, viscid mucus, often streaked with blood. The disease almost always occurs in the prime of life, between the years of puberty and forty-five, in which respect it differs remarkably from croup, which, as will be presently seen, is most common in young children.

It has been already intimated that one of the effects of acute laryngitis is the effusion of serum into the submucous cellular tissue. The infiltration, which is occasionally very great, is always most abundant around the edges of the glottis, which are frequently elevated into white, glossy, pendulous bags, resembling the gelatinous effusion which we sometimes see under the epidermis, after the application of a blister. This constitutes that form of the disease which was so ably described by the late Dr. G. L. Bayle, under the name of *œdema of the glottis*, in a memoir published at Paris in 1819.\* From the

\* See Nouveau Journal de Médecine, de Janvier, 1819. Also the Medico-Chir. Rev. for Sept. 1823, p. 452.

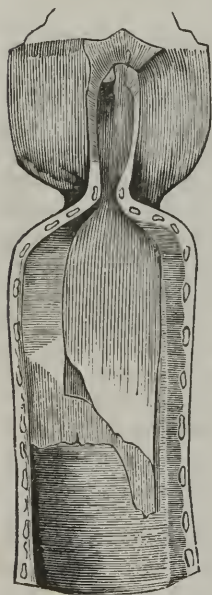


interesting cases recorded by this distinguished writer, the affection would seem to be much more common in adults, after the age of thirty-five or forty, than in early life. Its progress is usually very rapid, and its termination almost uniformly fatal, death being preceded by great anguish, and symptoms of suffocation. Out of seventeen cases of this disease, mentioned by Bayle, only one recovered. The difficulty of breathing in this affection appears to result, not so much from the absolute constriction of the chink of the larynx, as from the manner in which the tumid and infiltrated lips of the glottis are drawn in by the air, as it rushes from the mouth into the lungs.

Occasionally, purulent matter is found in the larynx; and, in a few cases, small abscesses have been detected, situated either in the ventricles of Morgagni, between the mucous membranes and the muscles, or between this organ and the pharynx. Bayle mentions several instances of this kind, in each of which there was a discharge of half an ounce of thick, creamy pus.

In other cases, together with the inflamed condition of the mucous lining, there is found an exudation of lymph, either in dots, in patches, or in the form of a continuous lamella, as in Fig. 116, from a preparation in my cabinet. In simple laryngitis, this deposition is extremely rare; but, in that variety of the disease which is known by the name of croup, nothing is more common. In this affection, which differs further from ordinary inflammation by its being almost exclusively confined to infancy and childhood, the effusion is often very rapid, and moulds itself accurately to the shape of the organ, to the walls of which it sometimes adheres with considerable pertinacity. Although it is occasionally limited to the larynx, yet the membrane usually passes into the trachea and bronchiæ, becoming gradually softer and more delicate, until finally, in the binary and ternary divisions of these tubes, it appears like a thin, mucous film. Upwards, it sometimes extends over the fauces into the mouth, and even into the nasal cavities. Such instances, however, are rare. Bretonneau first promulgated the opinion, which was subsequently espoused by numerous observers, that infantile croup is frequently preceded by pseudo-membranous inflammation of the pharynx. Guersent, in fact, estimates that nineteen out of every twenty cases of the disease originate in this manner. This however, is a mere conjecture, which requires further proof before it can be adopted.

Fig. 116.



In one hundred and twenty cases examined by Housnot, the false membrane was limited to the larynx and trachea in seventy-eight, while in forty-two, or one-third, it extended to the larger bronchia. Fig. 117, from Hunter, represents a portion of plastic lymph expelled from the lungs; it has a ramiform appearance, and must have reached into the smaller bronchia, which, however, is infrequent.

Varying in thickness, in different cases, the membrane seldom exceeds the third or fourth of a line, though in some instances it is the eighth or tenth of an inch. It is of a light greyish color, is composed chiefly of albumen and fibrin, and is generally much stronger, more tenacious, and more firmly adherent in the larynx than in the trachea and bronchial tubes; in the latter of which it is often loose or even floating. The mucous coat beneath this lining is usually highly injected, inflamed, and unnaturally rough, from the projection

of its mucous follicles. In slight cases, the color is of a light red, and occurs in patches, streaks, or points: in more severe ones, it is scarlet, brownish, or purple, and uniformly diffused.

To the presence of this plastic production, together with the tumefaction of the lining membrane of the trachea and bronchiæ, which so often accompanies the disease, is to be imputed, in great measure, the impediment to the respiration in croup. Sometimes portions of it are detached, and, by sticking in the air-passages, cause suffocation. In other instances, it is coughed up, either piece-meal, or in the form of a dense, inspissated cylinder, and the patient recovers. The organization of this membrane is admitted rather from analogy than from any positive observation. The occurrence, if possible, must be extremely rare.

Membranous croup, as already stated, is essentially a disease of early life. I have noticed it several times in children at the breast, and Duges states that he met with an instance of it in an infant only a few days old. From the observations of a great number of practitioners — Van Bergen, Home, Zobel, Cheyne, Rumsey, Barthez, Michaëlis, Salomon, Viesseux, Lucadou, Bernard, Vaillau, Crawford, Rosen, Pinel, Copland, Ware, and others — it would appear that it is most frequent in children from the second to the tenth year, and that it seldom, if ever, occurs, in a pure uncomplicated form, after the period of puberty.

It is worthy of remark that this disease is more common in male than in female children, owing mainly, perhaps, to the circumstance, that the former are more exposed than the latter to its various exciting causes, such as cold and damp. Of two hundred and fifty-two cases, treated by Gælis from 1797 to 1808, one hundred and forty-four were boys, and one hundred and eight girls. Jurine met with one hundred and nineteen cases of this disease, of which number seventy-two belonged to the male and forty-seven to the female sex. Of the cases treated by Rumsey by far the larger number were boys.

Croup occasionally assumes an epidemic feature, and some authors have even supposed that it might be infectious, though of this we have no sufficient proof. It is most frequent in winter, late in autumn, and early in spring, particularly during the prevalence of north-east winds, and is often complicated with disease of the lungs, bronchiæ, tonsils, and fauces.

Laryngitis sometimes becomes *chronic*, or it may have a disposition to assume this type from the very beginning. Such an alarming degree of prevalence has this form of the disease assumed among our clergy, that it may almost be viewed in the light of an epidemic. The inflammation is confined exclusively to the mucous lining of the larynx, and its peculiar characteristic is to terminate in ulceration. Slow and insidious in its attacks, the first symptoms often are merely slight hoarseness and cough, scarcely sufficient to attract notice, which gradually increase, and, unless arrested by treatment, destroy life, by inducing hectic fever, emaciation, and general prostration. Often do we see the uvula elongated, the tonsils and soft palate ulcerated, and the vocal

Fig. 117.



cords so much thickened as to encroach upon the glottis. The lining membrane of the larynx is usually tumefied, its glands enlarged, and its vessels engorged with dark blood. In this way have perished, in the prime of life, some of the brightest ornaments of the American church.

Inflammation of the larynx sometimes terminates in *ulceration*. 'This is very common in persons who are cut off by tubercular phthisis. Of one hundred and two patients, M. Louis found the epiglottis ulcerated in eighteen, and the rest of the organ in twenty-three. The erosions in the former of these structures were nearly always seated on the inferior surface; and, although they were generally superficial, yet they sometimes extended into the substance of the cartilage, destroying it partially in four cases, and completely in a fifth. In the larynx, properly so called, the ulcers were usually deep, from one to two lines in diameter, and of an irregularly circular shape, with pale greyish-looking edges, occasionally indurated and brittle. Their most frequent seat was, first, at the junction of the vocal cords; then these cords themselves; next, the base of the arytenoid cartilages; and, finally, the interior of the ventricles of Morgagni. Sometimes the vocal cords were partially destroyed, and the arytenoid cartilages stript of their natural coverings. A fact worthy of notice, in connection with this subject is, that ulcerations of the epiglottis were remarked twice as often in men as in women.\*

The textures in the immediate vicinity of these erosions are seldom much altered, either as respects their color or their consistence. When the symptoms which precede dissolution are denotive of high inflammatory action, the mucous membrane is apt to be reddened and slightly softened; but, in most cases, it is of a greyish hue, moderately dense, or even indurated.

The signs, during life, of ulcerated larynx, vary, as might be expected, according to the part that is affected, and also according to the extent, depth, and number of the erosions. When the vocal cords, the ventricles, or the arytenoid cartilages are implicated, hoarseness, alteration of the voice, pain, and a sense of heat and pricking, followed often by complete aphony, are the ordinary and almost invariable manifestations. The pain sometimes is quite severe, pungent, and lancinating, the cough excessively distressing, and the patient dies gradually worn out by hectic.

I have never seen the cartilages of the larynx ulcerated, but this condition has been noticed by others, though the instances wherein it has been found are rare. In the affection with which it usually occurs, in connection with ulceration of the mucous membrane, it occasionally leads to perforation, the symptoms which precede dissolution resembling those of phthisis. The diseased cartilage is slightly tumefied, and softened around the ulcers, the edges and base of which are rough, and of a light brownish color. The perichondrium commonly participates in the mischief, being injected, dark, thickened, ragged, and bathed in unhealthy looking pus. These ulcerations are most frequent in venereal, mercurial, and phthisical affections, in which large portions of these cartilages, or even entire pieces, are sometimes discharged.

More frequent, perhaps, than ulcerations are the *osseous transformations* which we sometimes meet with in the laryngeal cartilages. The pieces in which this change, which is natural in the aged, is most apt to take place, are the thyroid and cricoid, of each of which I have seen a considerable number of specimens. When thus affected, these bodies are usually very brittle, and contain a considerable quantity of thin, reddish, oily fluid. I have seen them, however, in a few instances, quite hard and firm, like the most perfect bone.

\* On Phthisis, p. 47. Boston, 1835.



When found in advanced life ossification of these cartilages is not to be regarded as a morbid condition, but as a natural process, which often commences as early as the thirty-fifth or fortieth year, and progresses until the conversion is completed.

Of ossification of the arytenoid cartilages an example is mentioned by Mr. Ryland,\* and another by Dr. Francis Travers.† In the former the thyro-arytenoid ligaments, the left arytenoid cartilage, and the greater part of the epiglottis were destroyed by ulceration; the mucous membrane of the trachea was extensively reddened, and the right arytenoid cartilage was partially ossified and carious. The patient, a man twenty-eight years of age, had never had any syphilitic affection. In the case related by Travers both the arytenoid and cricoid cartilages were much increased in size, and completely converted into bone. The subject was a woman, about fifty years old, who died from inanition caused by the pressure of the ossified larynx upon the œsophagus.

Ossification of the epiglottis is exceedingly rare. I am not aware that there are more than three instances on record, and all these are related by Paw.‡ A slight degree of induration, interfering more or less with the movements of the part, is of much more frequent occurrence. Both lesions usually coexist with disease of other portions of the larynx.

The *epiglottis* may be affected without the rest of the larynx participating in the lesion. The simplest form of disease is thickening of its mucous membrane, with ulceration of its inferior surface. The abrasions are generally small, superficial, and irregularly circular, their base, for the most part, being formed by the submucous cellular texture, though occasionally they extend into the substance of the fibro-cartilage. Sometimes, indeed, this body is entirely destroyed. Occasionally, the epiglottis is remarkably shrivelled and contracted, or singularly thinned and elongated, its form being altered so as to represent the shape of a battledore, the narrow extremity being at the mouth of the larynx. This condition usually coexists with ulceration, and constitutes what Professor Stokes§ has proposed to call the *leaf-like expansion* of the epiglottis.

The *muscles* of the larynx are also sometimes diseased. In some cases, they are infiltrated with tubercular matter; but more commonly, perhaps, they are atrophied, and thus cause various alterations of the voice, being no longer capable of producing proper tension of the fibro-elastic structure of the organ. The vocal cords, as they are termed, are occasionally affected. Andral says that he has seen them converted into a soft, inorganic pulp; and he refers to cases in which they had entirely disappeared, leaving the thyro-arytenoid muscles bare. In chronic inflammation, it is very common to find the ventricles of the larynx contracted; so that, in the advanced stages of the disease, they are merely represented, as it were, by a superficial, transverse groove. This narrowing seems to arise from hypertrophy of the mucous and submucous textures, by which the edges of the cavities are gradually approximated.

*Polypes*, of the same nature as those in other parts of the body, are occasionally found within the larynx. Formations of this kind, although quite rare, have been noticed by different observers. Two cases are recorded by Lieutaud;|| and the celebrated Desault¶ met with them not less than three times.

\* Diseases and Injuries of the Larynx and Trachea, p. 78. Phila. 1841.

† Medico-Chirurg. Trans. of London, vol. 7, p. 150.

‡ Primit. Anatom. de Ossibus, p. 10-21.

§ On Diseases of the Chest, in Dunglison's American Medical Library, No. 14, 1837.

|| Historia Anatomico-Medica, lib. iv., ob. 63.

¶ Œuvres Chirurgicales, par Bichat, t. ii., 252.

Other examples are mentioned by Pelletan, Trousseau, Dupuytren, Andral, Albers, Mayo, and Ryland. These bodies are of various sizes and of a globular or conical figure; they are usually attached by a thin narrow pedicle, and their free extremity is sometimes bifurcated. They are of a fleshy consistence, more or less elastic, and of a pale rose, greyish or whitish color. When laid open they are found to consist of cellular tissue, or of cellular tissue and fatty substance, invested by a prolongation of the mucous membrane. In their volume they vary from that of a large bean

Fig. 118.



to that of a hickory nut or even a guinea egg, and they are generally attached either to the ventricles of the larynx, to one or both of the vocal cords, to the lips of the glottis, or to the root of the epiglottis. When they are very large, or when their pedicle is of considerable length, they may project into the pharynx over the lateral boundaries of the larynx. In some instances a sort of pouch is formed within the larynx for their accommodation. Fig. 118 represents a small pediculated polyp attached to the left vocal cord.

These polypous growths are most common after the fiftieth year in persons affected with pulmonary phthisis. They have been observed with nearly equal frequency in both sexes. The symptoms which indicate their presence, although not characteristic, are occasional dyspnoea, alteration or extinction of the voice, and violent suffocative attacks, with an habitual sense of uneasiness and constriction about the region of the larynx.

The interior of the larynx is sometimes the seat of *warty excrescences*, not unlike those found upon the male and female organs of generation. They are usually connected with thickening of the lining membrane, and are probably the result of a syphilitic taint of the system. They

are attached either by a narrow pedicle or a broad base, and vary in length from half a line to a quarter of an inch; in their shape they are rounded, ovoidal, or conical; they are of a soft, fleshy consistence, and of a greyish or pale reddish color. Their surface is sometimes fissured or tuberiform, like that of a cauliflower. When these bodies are very numerous, the surface of the larynx looks as if it were studded with them.

Tubercles and hydatids are also sometimes found in the larynx; the latter are very rare, and the former generally coexist with pulmonary phthisis. Carcinoma of the larynx is also very uncommon. In fact, I am not aware that scirrhus, colloid, or melanosis has ever been met with in this situation. Of

primary encephaloid of the larynx two well-marked examples are mentioned by Dr. Albers of Bonn; another is related by Trousseau; and these, so far as my information extends, are the only instances of the disease on record. In the latter, the tumors existed in great numbers, and almost filled the larynx, covering the epiglottis and part of the trachea; they were of various sizes, isolated or agglomerated; and the mucous membrane between them was ulcerated and fungous. Numerous tumors of a similar nature were found in the adjoining cellular tissue.

A case in which a firm fibro-cartilaginous tumor was found closing the glottis, is recorded by Mr. Macilwain, in the thirty-fifth volume of the Edinburgh Medical and Surgical Journal. A similar mass existed on the outside of the larynx, and was connected with the internal one and also with the thyroid gland. The patient died of suffocation. Mr. Ryland mentions an instance, originally published in the Berlin Medical Gazette, for September, 1834, of a firm osseo-cartilaginous tumor, which was attached to the right thyro-arytænoid ligament. It was of the size of a walnut, nearly homogeneous in texture, covered by healthy mucous membrane, and pressed so much upon the mouth of the glottis as nearly to obliterate the passage for the admission of air.

II. The diseases of the *trachea* may be classed under the heads of inflammation, ulceration, ossification, and stricture.

*Trachitis* exhibits the same anatomical characters as inflammation of the larynx. The lining membrane is crowded with multitudes of minute, florid vessels; its follicles are enlarged and unusually distinct, and its surface is besmeared with thick, ropy mucus. Purulent fluid is occasionally found; and in some instances, as in croup, the whole tube is lined with a layer of adventitious membrane. Softening is seldom or never present, either in this affection, in laryngitis, or in inflammation of the bronchiæ. In chronic cases, the redness is less; but the vessels have occasionally a varicose arrangement; and the mucous tunic may be ulcerated, thickened or indurated.

*Ulceration* of the trachea is very frequent in tubercular phthisis, Louis having noticed this lesion in thirty-one patients, out of the one hundred and two, who died of this disease under his care. More common in the inferior than in the superior half of the tube, and behind than in front, or at the sides, the ulcers are generally of a circular shape, sometimes oval or oblong, and from the twelfth to the sixth of an inch in diameter, with flat, reddened edges, as if they had been scooped out of the subjacent cellular tissue. In some instances, the erosions are so small, close, and numerous, as to give the whole of the inner surface of the trachea a sieve-like aspect. Of this an interesting case is mentioned by Andral. When large and deep, the ulcers may denude the cartilaginous rings, invade their substance, and finally, destroying them, lead to perforation. In a few instances, there is a complete removal of the mucous lining over nearly the whole of the muscular structure, which, in such cases, is always much thickened and indurated.

Ulcers of the trachea sometimes heal. Of this, an instructive case is mentioned by Mr. Porter, in his Surgical Pathology of the Larynx. The patient recovered under the use of mercury, and, after enjoying good health for upwards of a year, died of another disease.

The signs of trachitis, whether simple or complicated with ulceration, are often remarkably obscure. Pain, tightness, and a sense of burning, just above and behind the sternum, are occasionally the chief symptoms; in general, however, there are superadded embarrassment of breathing, accompanied with a peculiar mucous rhonchus, severe cough, and copious expectoration of mucopurulent matter. The pain is sometimes highly distressing, and is increased



both by pressure and by inspiration. The voice is seldom much altered. Occasionally, the disease is almost completely latent; and cases occur in which the pain and uneasiness are referred entirely to the larynx, the patient feeling no distress whatever in the trachea, the actual seat of the disease.

The trachea is liable to become contracted by the thickening of its lining membrane, forming a sort of *stricture*, which varies in length from a few lines to several inches. In other cases the diminution of the caliber of the tube may be produced by the pressure of an aneurismal tumor, an abscess, an enlarged thyroid gland, or a mass of diseased lymphatic ganglions. The degree of contraction may vary from the slightest change in the natural size of the trachea to almost complete obliteration. Tulpius\* mentions an instance, apparently in the best possible faith, in which the tube was so much compressed by a scirrhus tumor that it would hardly admit the passage of a common probe.

*Dilatation* of the trachea may occur under two varieties of form; in one it affects the entire circumference of the tube, in the other it is limited to its posterior surface. In the first, which is the more frequent of the two, the walls of the trachea are atrophied, and its caliber is more or less increased in diameter, sometimes a fourth or even a third beyond the normal state. The dilatation seldom involves the whole length of the canal; it is most common in old subjects, and is usually associated with marasmus and pulmonary emphysema.

The second form of dilatation is the *saccular*. It is confined to the posterior wall of the tube, and consists in an extrusion of the mucous membrane across the muscular fibres, which are unusually florid and hypertrophied, while the yellow elastic tissue behind them is wasted and hardly perceptible. The mucous lining itself is thickened, and sprinkled with enlarged follicles. The number of sacs varies; sometimes there is only one, sometimes there are two or three, and sometimes, again, they extend along the whole course of the trachea, and even beyond it to the bronchial tubes. They are of a rounded or ovoidal shape, and rarely exceed the volume of a cherry or filbert. This form of dilatation is generally produced under the influence of chronic inflammation of the lining membrane of the trachea.

The rings of the trachea, being of a fibro-cartilaginous texture, seldom *ossify*. When this transformation takes place it usually occurs in small points, which, by coalescing, may at length embrace the entire ring. Of this I witnessed an example, not long ago, in a man seventy-five years of age. The different tissues of the tube were remarkably dense, inelastic, and brittle, requiring only slight traction to tear them. All the rings were completely ossified. De Haent† and Morgagni,‡ each relate an instance where this transformation affected not only the rings of the trachea but likewise those of the bronchiæ and their primitive ramifications.

III. *Acute bronchitis*, although it may exist as an independent disease, yet in most cases it is united with inflammation of the trachea, the larynx, or pulmonary tissue, of which it forms so important a component. The mucous coat is found, on dissection, to be deeply injected, and of a bright crimson, lilac, or purple color, diffused, or in patches of various sizes. It is rarely much thickened or softened; but sometimes it is considerably augmented in firmness and density, so as to tear no longer with the same facility as in health.

\* Obs. Med., Lib. i., cap. xlv., p. 82.

† Methodus Medendi, p. vfi., cap. ii., t. iii., p. 281.

‡ Epist. xxiv, § 16.

Purulent matter is occasionally observed; and, in violent cases, it is not unusual to find the smaller tubes filled with bloody serosity, blended with froth or globules of pus. In the early stage of this disease, there is always a suspension of the natural secretion. In a short time, however, it is re-established; and it is then found to be thin, transparent, and somewhat acrid. As the inflammation advances, it becomes thicker and more abundant, assumes a yellowish color, with a slight greenish cast, and adheres with so much firmness and tenacity to the bronchial tubes, as to be expelled with great difficulty. Obstruction is thus created in the air-vesicles of the lungs, and hence, on opening the thorax, these organs seldom collapse.

In *chronic bronchitis*, a disease of very frequent occurrence, the color of the mucous tunic is usually several shades darker, verging more on livid, violet, or mahogany. Not unfrequently, however, the membrane is of a light greyish tint, or even much whiter than in the normal state. The thickening and augmentation of density are carried much further than in acute bronchitis; and the natural secretions are usually very copious, opaque, of a deep yellowish color, and almost always puriform. With these signs of disease, we frequently find small ulcers, hypertrophy of the mucous and other textures, and dilatation of the bronchial tubes. Softening is rarely present, and never to any very great extent.

The respiratory murmur, in this disease, is diminished in intensity: but the sonorousness of the chest is not sensibly impaired, except in cases embracing a large extent of surface. The cough, at first dry, loud, and hoarse, becomes gradually moist, loose, and more frequent; the breathing is accompanied with a mucous rhonchus, most distinct at the base or posterior margin of the lungs; and the sputa, which before were thin, saltish, and slightly glutinous, are now opaque, yellowish, and ropy. Occasionally, they are marked with dots of blood, or mixed with pus. In chronic bronchitis, the expectoration is generally puriform, and sometimes of a greenish, dirty greyish, or brownish color, from the admixture of black, pulmonary matter. In neither of these complaints are the sputa much offensive; in most cases, indeed, they are perfectly inodorous.

*Ulceration* of the bronchial mucous membrane is less frequent than that of the trachea, and still less than that of the larynx. Louis, in the whole of his researches, only met with seven cases of this disease. From the observations, however, of Hastings and Andral, it would appear that the lesion is more common than is usually supposed. The ulcers are generally small, clean, superficial, and of a dirty greyish color, with somewhat tumid and reddened edges.

Fig. 119.

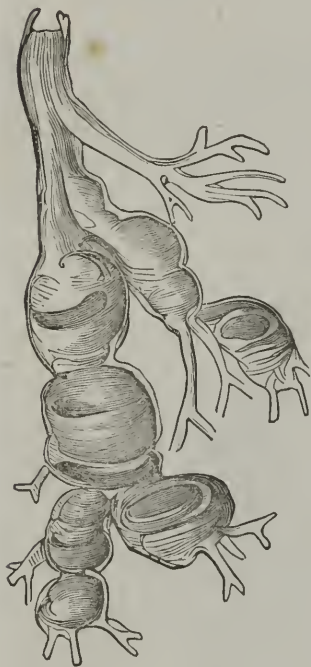


They seldom extend beyond the mucous and submucous textures, and are rarely met with in the small bronchial tubes.

The symptoms of ulcerated bronchiæ differ little from those which have been enumerated as characterizing trachitis. There is, in general, however, more difficulty of breathing, more deep-seated pain, more emaciation, and more hectic fever.

*Dilatation* of the bronchiæ is frequently met with in old asthmatics, and in children after severe attacks of hooping-cough.

Fig. 120.



The affection was first described by Laennec, who has given a number of interesting examples in illustration of its pathology. It presents itself under two varieties of form. In the first (Fig. 119), the dilatation is uniform throughout, and may attain the diameter of a goose-quill or even of a finger. Sometimes several branches of the same trunk are thus affected, each terminating in a sort of cul-de-sac. In other cases, the dilated tube regains its normal caliber, and ends in the usual way. In the second variety (Fig. 120), the bronchia presents a nodulated appearance, like a varicose artery, or an absorbent vessel, forming a series of globular swellings, on each side of which the canal is of the natural size. Occasionally, there is only one such dilatation, which may attain the magnitude of a cherry-stone, a marble, or a walnut.

Various are the appearances of the mucous membrane in this affection. In the generality of cases, it is thickened, injected, and indurated, with its surface covered with dense, inspissated mucus. In others, especially in the second variety of the disease, the membrane is transparent, and so extremely attenuated, as to look like a shining vesicle. Occasionally, again,

all the component tissues are in a state of hypertrophy, or they are indurated, rigid, and almost of a fibro-cartilaginous consistence. Cases also not unfrequently occur in which the mucous tunic is softened, and convertible into a greyish, pulpy substance. When the dilatations are considerable, and embrace a large number of tubes, the intervening pulmonary tissue is hardened, probably from the effects of chronic irritation, imperfectly crepitant, and of a much lighter color than natural.

This lesion is said to be most common in the upper lobes of the lungs : rarely is the entire organ affected. It is usually dependent upon chronic inflammation, and is sometimes produced with much celerity. In hooping-cough, it has been known to attain a very considerable size in the course of a few months. A frequent, forcible inhalation of the air, when the bronchiæ are enfeebled by disease, and obstructed with thick, ropy mucus, seems to be the immediate cause of this dilatation. It occurs at all periods of life, and, according to Guersent, is occasionally congenital.

The physical signs of this affection are, bronchial respiration, loud mucous or gurgling rhonchus, and dulness on percussion, from the condensation of the pulmonary tissue. There is seldom much dyspnoea ; the emaciation is not



great ; and the cough and sputa are similar to what we observe in chronic bronchitis, which the dilatation so often accompanies or succeeds.

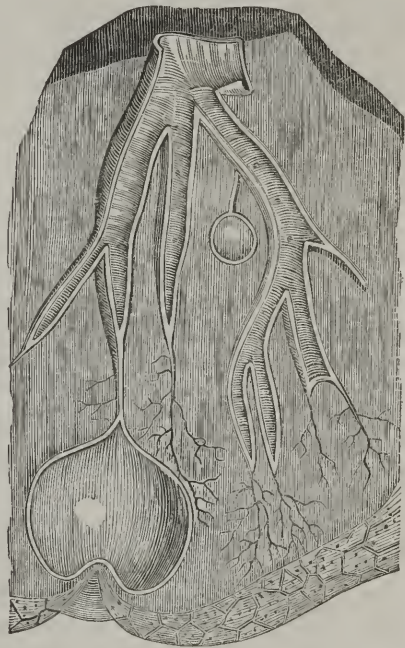
There is another species of alteration of the air-tubes, the reverse of that just described, which has of late attracted the special notice of pathologists ; I mean *obliteration* of the bronchiæ. The first account of this singular lesion was given a few years ago by Mons. Reynaud, in a highly interesting monograph, in the fourth volume of the Memoirs of the Royal Academy of Medicine of Paris. It would appear, from the researches of this distinguished physician, that narrowing and obliteration of the air-tubes are much more common than has hitherto been supposed by writers on thoracic diseases ; but what the probable proportion is, in a given number of subjects, is a circumstance which has not been determined.

This lesion affects principally the smaller bronchiæ, especially when it is produced by inflammatory irritation, accompanied with the effusion of plastic lymph. In such cases, the contraction is liable to be mistaken for an obliterated vessel. When, on the other hand, it is caused by the pressure of an external tumor, it occasionally involves the larger-sized branches, or even one of the primitive trunks. Hypertrophied lymphatic ganglions sometimes give rise to an obstruction of this kind, followed by a gradual wasting of the corresponding lung. The lesion under consideration is most common in the superior lobe of the pulmonary organs, — a circumstance which is easily explained by the great frequency of tubercular disease here, with which it often coexists. The number of tubes that may be thus affected is variable ; occasionally, only a single one is obliterated ; at other times, the lesion is observable in three or four ; and in a few rare cases, all the branches of an entire lobe are implicated.

Obliteration of the air-passages presents itself under two varieties of form. In the first (Fig. 121), which is by far the most common, the tube is uniformly contracted throughout its entire length, being converted into a firm fibro-cartilaginous cord, from the sides of which numerous processes are detached, which ramify in an arborescent manner, and the diameter of which scarcely equals that of a bristle. This variety, which may be said to resemble the continuous stricture of the urethra, usually affects the smaller divisions of the bronchiæ, and is almost always complicated with dilatation, the caliber of the tube above the constriction being seldom perfectly natural.

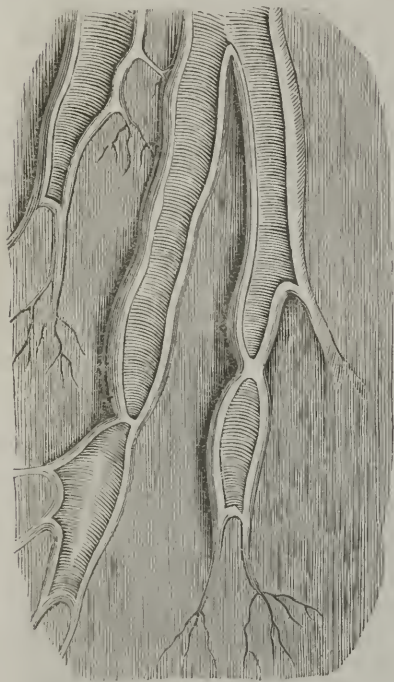
In the second variety (Fig. 122), the obliteration occupies only a very small portion of the tube, and is observed principally in bronchiæ of the second and third order. The affected part rarely exceeds half an inch in length ; generally, indeed, it is not near so long, and not unfrequently it presents the appearance as if the tube had been compressed by a narrow tape or ligature. In this

Fig. 121.



variety, the diameter of the bronchiæ above and below the obliterated point may be natural, diminished, or, as is more commonly the case, increased. Several tubes may present this species of contraction in the same lung.

Fig. 122.



The causes under the influence of which this lesion takes place are various, but may all be referred to the following heads : 1, the formation of fibrinous concretions ; 2, thickening of the mucous membrane ; 3, external pressure ; 4, the existence of accidental products within the tube. Of these, the first and second are by far the most common, and are both the immediate result of inflammatory irritation. The principle on which the one acts is similar to that which obtains in the production of contraction and obliteration of the arteries : the type of the other is to be found in the formation of stricture of the urethra, the nasal duct, œsophagus. Let us be understood. It is well known that the bronchial tubes are liable to inflammation, followed not infrequently by an effusion of plastic lymph. The substance thus poured out being permitted to remain, it gradually contracts adhesions with the mucous membrane ; and, in this way, an effectual barrier is formed, by which the ingress of the air is permanently interrupted. Thus the function of the tube is annulled ; and, in progress of time, it is converted into a firm, fibrous cord, like an artery that has been tied with a ligature.

Thickening of the mucous membranes is observed in all parts of the body in which these structures are found ; and it is therefore not at all surprising that it should occasionally produce narrowing and obliteration of the bronchiæ. In the urethra, as is well known, it is a frequent cause of stricture ; and, in the nasal duct, there is reason to believe it a very common source of lachrymal fistula.

The third cause which has been enumerated, as liable to produce obliteration of the air-passages, is external pressure. This may be occasioned, as already stated, by a tuberculated lymphatic ganglion, an aneurismal or other tumor, or, as more generally happens, by pleuritic effusions, exerting a permanent influence.

Lastly, obliteration of the bronchiæ is occasionally caused by the presence of inspissated mucus, by deposits of tubercular matter, or by the inhalation of particles of foreign substances.

A peculiar *flattening* of the left bronchial tube is occasionally produced by dilatation of the cavities of the heart, especially the left auricle. The notice of pathologists was first called to this affection, a few years ago, by Mr. T. W. King, in a short paper in Guy's Hospital Reports,\* in which he has related the particulars of four cases in illustration of the subject. The first was that of a

\* No. vi. April, 1838.

boy, fifteen years of age, who had long been afflicted with dyspnœa, palpitation of the heart, and serous effusions. The lungs were extensively diseased, the heart was greatly enlarged, and the left bronchial tube was flattened by the pressure of the corresponding auricle, which was more capacious than the other cardiac cavities. In the second case, that of a man, twenty-eight years old, there were occasional symptoms of pulmonary obstruction for a long time, and latterly manifest disease of the heart, with distressing palpitation. The pericardium was closely adherent to the heart, the cavities of which were greatly dilated, the left auricle most of all, and the left ventricle least. The cardiac tissues were loose and unhealthy, the mitral opening was much reduced in size, and the lining membrane of the organ was opaque and unequally thickened. The lungs were fleshy, turgid, and emphysematous; and the left bronchus, close to its first division, was decidedly flattened. In a third case, the patient, a female twenty-one years of age, was ill altogether twenty months, the symptoms being those of a general dropsical affection, with marked disease of the chest. Both auricles were very much dilated, the left more than the right, and the lining membrane of the former was opaque, thick, and uneven. The ventricles were hypertrophied, as well as otherwise affected, and the substance of the heart was rather flabby, tough, and dark. The lungs were turgid, œdematous, and slightly apoplectic, and the left bronchus, behind the corresponding ventricle, was evidently much flattened. Finally, a child, aged two years and four months, died anasarca, after having suffered from an early period from dyspnœa, attended with a cœrulean hue, frequent palpitations, and enlargement of the spleen. The cardiac cavities, especially the left auricular, were all dilated, the tricuspid and mitral valves were imperfect, and the oval foramen was large enough to admit a catheter. The bifurcation of the trachea appeared very slightly compressed, even at the commencement of the right tube, whilst that on the left side was much and permanently flattened.

Mr. King states that he has observed another case fully as well marked as the preceding, and that he has seldom found the tube in question reduced to less than one half of its natural extent. His researches are highly interesting, and cannot fail to receive the attention of future inquirers. What functional derangement, if any, this species of compression of the bronchial tube produces, has not been ascertained; the probability is, that it is not very great.

The mucous membrane, near the point of obliteration, may be normal, thickened, or attenuated: in some instances, it is unnaturally red, softened, or incrustated with plastic lymph. In the majority of cases, as was previously stated, the lesion is associated with dilatation, either of the same, or of the neighboring tubes. This is particularly apt to happen when it implicates the larger trunks. The parenchymatous substance itself is variously altered. Frequently it is remarkably emphysematous, or even rarefied; as, on the other hand, it is sometimes quite dense, solidified, and impermeable to the air. The adjoining vessels are seldom much affected, except when the obliteration occupies a large extent of surface; in which case, the smaller branches are often very much diminished in size, plugged up with fibrinous concretions, or transformed into dense, thread-like cords, which are easily distinguished by their dark greyish color.

The consequences of obliteration of the bronchiæ are exceedingly variable, and can be pointed out only in a very general manner. When of limited extent, the lesion does not produce any marked difficulty: as the neighboring tubes, under such circumstances, are always rendered sufficiently large to compensate for the loss sustained by the affected part. Should it, on the contrary, be more considerable, the effects will of course be more serious. The cor-



responding portion of the lung, for example, being deprived of air, will gradually fall into a state of atrophy, its surface will become puckered, and its substance rendered abnormally dry and dense, almost like a piece of liver. Dulness on percussion and diminution of the respiratory murmur, will probably be found, when this lesion shall have undergone more thorough investigation, to be the principal physical signs of its existence.

The bronchiæ are liable to *ossification*, by which many of the more minute, and even some of the larger branches are occasionally converted into hard, solid pencils, perfectly impermeable to the air. Andral\* gives a singular example of ossification of these tubes. In dissecting the body of an old man, he found the lung full of hard masses, which were composed of an infinite number of bony spicules, arranged in a beautiful arborescent form, with a cavity in each so small as scarcely to admit a hair. Laennec and some others speak of having met with polypous growths in the bronchiæ; but the occurrence of these bodies in this situation is by no means established.

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## SECTION II.

### OF THE LUNGS.

I. The lungs are two soft, spongy bodies, and occupying the lateral parts of the thoracic cavities, which they fill in such a manner as to leave no space whatever between them and the surrounding structures. Separated from one another by the heart and mediastinum, they are attached below to the diaphragm by means of a fold of the pleura, and are retained in their situation chiefly by the trachea and pulmonary vessels, from the former of which they appear as if they were suspended. In their shape, the lungs are somewhat conical, the apex being above, and the base, which is cut off from before backwards, and from above downwards, resting on the diaphragm. Their *volume* always accurately corresponds with that of the thorax and heart. Hence the quantity of air which they are capable of containing must vary considerably in different individuals, being greater in those whose pulmonary organs are well developed than in those in whom their growth has been impeded. The average amount, however, has generally been computed at one hundred and forty-five cubic inches, of which one-fifth is probably renewed at every inspiration. In a grown-up, person, of ordinary stature, the *weight* of the lungs is about three pounds, or, as compared with the rest of the body, as one to forty-five.

If the lungs be artificially inflated, it will be found that they differ a good deal in *size*,—the left being narrower, but longer than the right, owing to the fact that the diaphragm from the obstruction caused by the liver, does not descend so low in the latter as in the former direction. Each organ is divided into several lobes, by a deep fissure, which runs obliquely downwards and forwards, commencing on a level with the fourth dorsal vertebra, and terminating at the anterior margin of its base: the upper lobe of each is thus rendered conical in its figure, whilst the inferior, which is also the larger, is nearly quadrilateral. The left lung has only two lobes, whereas the right has three,—the third being intermediate, in size as well as in situation, between the other two.

The *outer surface* of each lung is smooth and convex, especially behind: it

\* Pathological Anatomy, vol. ii., p. 308.

accurately corresponds with the walls of the thorax, with which it is always in contact, so that no air can intervene between them ; and it is, moreover, perpetually bedewed with a serous exhalation, which enables the organ to move freely and easily upon the surrounding parts. In consequence of disease, however, causing effusion of plastic lymph, adhesions often exist in this situation, which are sometimes so strong and extensive as to impede, in a very serious manner, the free exercise of the pulmonary tissue. The *inner surface*, which is slightly concave, particularly that of the left lung, rests against the pericardium and mediastinum, and receives, a little above its middle, the insertion of the bronchial tubes and the pulmonary vessels, forming, by their aggregate, what is called the *root* of the lungs. The entrance of these structures takes place considerably nearer the posterior than the anterior border of the inner surface, and their position is such that the pulmonary artery is above, the two veins below, and the bronchiæ behind and between them. This fact is of no little importance, especially in reference to the ærial tubes, and should not be overlooked when engaged in sounding and ausculting the chest.

The *anterior margin* of the lungs is thin and rather sharp, and inclines obliquely downwards and forwards, covering, in great measure, the pericardium, together with the organ which it envelopes : that of the left side is slightly excavated, towards the lower part, for receiving the point of the heart, which is always exposed at this situation, even during the most thorough distention of the air-cells. The *posterior margin* is thick, rounded, and lodged in the groove formed between the dorsal vertebræ and the heads of the ribs, its direction being nearly vertical.

The *base* of the respiratory organs is somewhat concave, and rests on the upper surface of the diaphragm, whilst the *apex* forms a rounded, narrow prominence which ascends between the scaleni muscles, the trachea, and the last cervical vertebra. When the subject lies on the back, with a block under his shoulders, it will be found, as a general rule, that this portion of the organ ascends as high as an inch above the level of the first rib, and occasionally, indeed, even twice that distance. This is more particularly the case when one lung, in consequence of disease of the other, is obliged to perform as it were a double function. This arrangement, a knowledge of which is of no little importance in reference to the lesions of the pulmonary tissue, has not been sufficiently dwelled upon by anatomists ; in fact, very few seem to be even aware of its existence. How far it influences the production of tubercles, which are so frequently observed in the superior lobes of these organs, is a topic concerning which we are still, in great degree, in the dark.

With respect to their *color*, the lungs vary not only in the different periods of life, but also under different circumstances of health and disease. Hence it is rarely that we find them precisely alike in any two cases. In the fœtus, anterior to respiration, the color of the lungs is of a uniform brownish red. After this process has taken place, they acquire a light florid complexion, which generally continues until about the period of puberty, when it gradually passes into a greyish red, intermixed with small lilac-looking patches. In progress of time, as the individual grows older, the color is converted into an iron grey, with narrow streaks of still darker appearance. These streaks are frequently quite black ; and they appear to depend upon the deposition of a peculiar pigment, which, as it is most abundant between the lobules and their connecting cellular tissue, generally imparts to the surface of the lung a singularly variegated aspect, — some of the figures being triangular, some square, some hexagonal, and some lozenge-shaped. The matter in some instances is

poured out in small rounded spots, separated by intervals of healthy tissue, and varying in diameter from that of a mustard-seed to that of a five-cent piece. It is seldom observed before the thirty-fifth or fortieth year; and notwithstanding what Laennec has said to the contrary, can be easily distinguished from melanosis, both by its color, and by the peculiarity of its arrangement. It also imparts its tint much less readily to linen and other articles than the latter of these substances.

It is worthy of remark, that, in general anæmia, the lungs usually participate in the exsanguine condition of the system. I have repeatedly examined the lungs of persons who had lost an immense quantity of blood, either by the lancet or otherwise, during their last illness; and, in such cases, I have invariably found them of a pale, blanched appearance; nor did they emit, on being incised, more than a few drops of fluid. The pulmonary organs of the victims of the guillotine have been said, by the French writers, to be unusually white; and the same phenomenon is generally observable in animals that are bled to death, as I have convinced myself from personal observation. It is also deserving of notice, that, no matter what may be the disease of which the individual dies, the posterior part of the lungs is almost always of a much deeper color than the rest, owing to the natural tendency which the blood has to accumulate in the more dependent situations of the body. The engorgement, which gives rise to this difference of complexion, frequently commences during the last struggles of life, and is probably not completed, in the majority of instances, until a few hours after dissolution, or until the blood is partially coagulated. Conjoined with this state there is occasionally an œdematous appearance of the pulmonary tissue, arising from the effusion of frothy serosity. This phenomenon has been confounded with the infiltration of the first stage of pneumonitis, from which, however, it is easily distinguished both by its situation, which is always in the most dependent portion of the lung, by the want of inflammatory redness, and by the absence of fibrin.

The *consistence* of the lungs, like their color, varies according to the period of life, and according to the kind of death. Generally speaking, they have very little density, and hence they may be very easily compressed, so much so, indeed, that they will only imperfectly resume their original condition. In the fœtus, before respiration has taken place, they are hard and firm, like the substance of the liver; but, after birth, they are soft, flexible, and elastic; air-bubbles may be pressed out of them; and, when cut into, they distinctly crepitate. Their specific gravity is likewise decreased; and, on being placed in water, they readily float on its surface. Their texture, however, notwithstanding these properties, possesses such a degree of tenacity as to render it by no means easy to tear it.

The parenchymatous substance of the lungs being essentially composed of the ultimate ramifications of the bronchial tubes and the pulmonary vessels, it will be necessary to describe these parts before we proceed to contemplate its minute structure. Externally, each of these organs is invested by a reflection of the pleura, a delicate serous membrane, whilst its interior is lined by a prolongation of the mucous tunic of the wind-pipe.

Behind the arch of the aorta, opposite the third dorsal vertebra, the trachea divides into two branches, called the *bronchiæ*, which incline laterally towards the inner surface of the lungs, being separated from each other nearly at a right angle. The right tube is larger but shorter than the other: it is directed almost horizontally outwards, and enters the corresponding organ on a level with the fourth dorsal vertebra: the left, which is more oblique, is about an inch longer than the right, and has therefore to descend somewhat lower before it can reach



the left lung. On arriving at its place of destination, the right bronchia divides into three, the left into two branches; and these, again, resolve themselves into smaller tubes, so that, by continuing this division through five or six successive stages, numerous canals are formed, which pervade the pulmonary organs, in every possible direction, diminishing regularly in size as they augment in number. An interesting fact with regard to the difference of the natural sound of respiration between the two lungs has been recently pointed out by Dr. Gerhard, of Philadelphia. He has ascertained that the peculiar blowing noise, observable at the right superior lobe, is owing to the greater caliber of the corresponding bronchial tubes, which is nearly double that of those on the left, where there is no such sound.

The bronchiæ and their primitive divisions are made up of the same textures as the trachea, of which they may be regarded merely as so many prolongations. As their ramifications, however, become more frequent, the cartilaginous rings gradually lose their annular form, and degenerate into small irregular lamellæ, which, succeeding each other less rapidly than formerly, are placed in different parts of the circumference of the canal, so as still to preserve its cylindrical shape. The pieces thus by degrees become more and more scattered and imperfect, until they at length completely disappear. The other structures, however, are continued on to the ultimate ramifications of the bronchiæ; and, though, with the exception of the mucous membrane, they can be no longer discerned, even with the aid of the microscope, there is every reason to conclude, both from analogy and from the natural resiliency of the lungs, that they still exist. The mucous lining in this situation is extremely delicate, smooth, and polished, being reduced to a thin transparent film. By means of a good glass, longitudinal folds may be seen on its free surface, which is also studded with hundreds of minute follicles. With regard to the tubes themselves, they spread out in different directions, with a caliber scarcely large enough to admit a common bristle.

The lining membrane of the bronchiæ, as it passes from the larger to the smaller ramifications, is supposed by some pathologists to be transformed from the mucous to the serous texture, or at any rate to undergo very important modifications of structure. Such, amongst others, is the opinion of Mons. Reynaud, of Paris, and of Dr. Stokes, of Dublin. How this notion originated it is difficult to determine, for it is by no means necessary, I conceive, that, because these tubes are occasionally the seat of plastic inflammation, they should be lined with a serous membrane. The mucous textures are not, it is true, very prone to this species of irritation; still the formation of fibrinous concretions is sufficiently common, even in them; and the effusion of lymph in the minute bronchial ramifications should not therefore be a matter of greater surprise than in the larynx, œsophagus, nasal duct, uterus, or bowel. That the lining membrane is somewhat modified in these situations I do not feel disposed to deny, but that the change is so complete as is contended for by certain writers, seems to me to be unfounded in fact, and unsupported even by analogy.

The *lymphatic vessels* of the lungs are exceedingly abundant; and here, as elsewhere, they are divided into two sets, the one being superficial, the other deep-seated. In front of the inferior extremity of the trachea, as well as around its primitive divisions, are a considerable number of black, dirty-looking bodies, called, from their situation, the *bronchial glands*. In their *size*, they vary between a pea and a hickory-nut, and most of them are of a rounded, flattened shape. Their dark color would seem to be derived, according to Vauquelin, from a deposition of pure carbon. They are evidently nothing but lymphatic ganglions, which undergo various changes during the progress of life, and

which, in old age, almost always contain some earthy matter, either in a soft or solid state.

The lungs are supplied with blood from two sources, the pulmonary and bronchial arteries. The first is a short, stunted vessel, about two inches in length, which arises from the base of the right ventricle of the heart, and proceeds obliquely upwards towards the left side of the chest, dividing opposite the second dorsal vertebra into two large trunks, one for the right, the other for the left lung, the former being the larger and longer. On reaching the parenchymatous substance, these two trunks separate into innumerable ramifications, which accompany those of the bronchial tubes to their final termination in the air-cells, on the delicate walls of which they become capillary, being spread out upon them in the form of a beautiful net-work. These vessels have nothing to do with the nourishment of the lungs; they are designed simply to convey dark venous blood from the right side of the heart, in order that it may be subjected to the influence of the atmosphere; and, having derived this benefit, the fluid is sent, by means of appropriate veins, to the left cardiac chambers, from whence it is transmitted to the different parts of the body. Imperfect valves are said to exist in these veins; but of the truth of this assertion, recently made by Professor Meyer, of Bonn, I have not been able to satisfy myself.

The work of nutrition is delegated to another set of arteries, called the *bronchial*. These vessels, which are extremely small in comparison with the volume and weight of the respiratory organs, are generally two in number, one on each side: but sometimes there are three, four, or even five. In the majority of cases, they arise from the aorta, either separately or by a common trunk; but occasionally the right is given off by the first intercostal or internal mammary artery. Soon after their origin, they send some minute twigs to the œsophagus, the pleura, and the pericardium; and, on reaching the root of the lungs, each divides into four or five branches, which follow the ramifications of the bronchial tubes, and freely anastomose with the pulmonary arteries. The bronchial veins, which return the residual blood, unite into several small trunks, which pass out at the root of the organ, and open into the azygos and pulmonary veins: occasionally, some of them terminate in the superior cava, or in the œsophageal, or first intercostal veins, or even, as has been observed by Winslow, Haller, and Hildedrandt, in the left auricle of the heart.

The lungs are furnished with *nerves* from the pulmonary plexus, which are made up chiefly by the par vagum, assisted by a few branches from the great sympathetic. Some of these nerves penetrate the parenchymatous substance in company with the divisions of the bronchiæ, whilst the others form an inextricable interlacement on their outer surface. It was formerly supposed that the branches of the sympathetic were appropriated exclusively to the bronchial tubes, and those of the par vagum to the pulmonary vessels; but the recent researches of Reisseissen, and other anatomists, clearly show that this opinion is erroneous.

The sources whence the lungs derive their nervous supply are worthy of being borne in mind, as they enable us to explain many of their sympathetic derangements. Indeed, there are no organs in the body which are so prone to suffer in this way as the pulmonary. In cerebral affections, especially such as are characterized by symptoms of compression, the lungs are almost always greatly oppressed, performing their functions in a tardy and imperfect manner; and every body knows how much they are involved in diseases of the stomach, liver, and bowels. In chronic gastritis they often become the seat of the most distressing cough; and the sympathetic irritation thus induced is frequently carried so far as to give rise to the development of tubercular phthisis. The

mere mention, however, of these connections must suffice. The subject is one of deep interest to the practitioner; and, for a more ample account of it than our limits will enable us to furnish, we beg leave to refer the reader to the writings of Dr. Philip\* and Dr. Todd,† of England, in which will be found much valuable and instructive information.

The different structures here described, as entering into the composition of the pulmonary viscera, are united together by cellular tissue, and so disposed as to form a series of small lobules, of an irregularly angular figure, which, when carefully inspected, are found to consist of clusters of minute cells, scarcely the hundredth part of an inch in diameter. These cavities are of a spherical shape, and may be considered as the ultimate terminations of the bronchial tubes, to which they are appended like bunches of little buds. Their parietes, which are of great tenuity, and which Haller has estimated as being about the thousandth part of an inch thick, are probably formed exclusively by the mucous membrane of the bronchiæ, and naturally lie in close contact with each other. Over their outer surface are scattered, in immense profusion, the delicate capillaries of the pulmonary vessels, and here, during life, the blood is constantly subjected to the influence of the atmosphere, so as to be converted from venous into arterial, which appears to be the grand object of the respiratory function. Internally, the air-cells are bedewed with a thin, mucous exhalation, the quantity of which, in the twenty-four hours, including that of the trachea and mouth, has been variously estimated from six to twenty ounces.

It would appear, from the recent researches of Professor Horner,‡ that the air-cells of the individual lobules, contrary to the general opinion of anatomists, freely communicate with each other laterally, precisely like the cavities of the bones, or those of a sponge. The vesicles of different lobules, however, have no such connection, the intercourse between them being established solely through the ramifications of the bronchial tubes. This arrangement is easily shown by distending the air-cells with tallow, which, after the lungs have been dried, is to be removed with spirits of turpentine. By this process, their natural size is preserved, and they are seen to communicate freely with each other. The aggregate of the internal surface of the pulmonary vesicles is immense. Dr. Monro§ supposes that it is nearly thirty times greater than that of the whole external area of the body; and this evaluation is probably not far from the truth, especially if there are, as he conjectures, upwards of half a million of these little cavities in every cubic inch of parenchymatous substance.

The parenchymatous structure, then, is composed of a great variety of tissues, which are cemented together by cellular substance. This substance is remarkable for its great softness and delicacy. It is perfectly destitute of fat, but often contains, as was previously intimated, a considerable quantity of black pigment, which is generally most conspicuous on the surface of the lungs, and which appears to be simultaneously deposited with that of the bronchial glands. It was formerly supposed that the interstices of this tissue communicated with the air-cells; but more careful observation has demonstrated that this is not the case. Externally, the lungs are enveloped by a reflection of the pleura, which is united to them by the same kind of cellular substance as that which pervades the interior of these organs, — a circumstance which accounts for the fact that inflammation of one of these structures seldom exists long without involving the other.

\* On Indigestion, 1821.

† Cyclopædia of Practical Medicine, article *Indigestion*.

‡ Special Anatomy, vol. ii., p. 143. Fourth edition.

§ Elements of Anatomy, vol. ii., p. 93. Second edition. Edinburgh, 1831.



It only remains that we should make a few remarks on the natural sounds of respiration, with reference to auscultation, which closely connects itself with the present topic.

The entrance of the air into the respiratory passages produces a peculiar sound, which varies in its characters in the larynx, the trachea, the bronchiæ, and the pulmonary vesicles. In the latter, the sound is somewhat soft and silky, and constitutes what is called the *respiratory* or *vesicular murmur*. In the other situations, the sound is more dry, and destitute of that crepitating nature which accompanies the expansion of the air-cells. This is the *bronchial* respiration of Laennec and other writers.

Although the respiratory murmur may be recognized at all points of the chest, yet there are some situations in which it is much more distinct than at others. Thus it is particularly loud in the arm-pits, in the space comprised between the collar-bone and the trapezius muscle, below the mammary gland, and at the inferior two-thirds of the back part of the chest, — regions where the thoracic parietes are naturally very thin, and the lungs therefore comparatively superficial. Age also exerts a considerable influence upon the energy of the breathing murmur. It is always remarkably strong in children, so much so as to have received the name of *puerile respiration*, — a character which it sometimes retains nearly throughout the whole of life. Towards puberty, the sound in question gradually diminishes in intensity; and, in old age, it is often comparatively feeble. It is likewise more faint in the corpulent than in the emaciated, and in men than in women; though, as respects the latter, the difference is usually very slight.

The cause of the vesicular murmur is probably the rustling of the air against the sides of the pulmonary vesicles, as it passes in to fill the vacuum created by the elevation of the ribs and the descent of the diaphragm. In expiration, the fluid is expelled in a very gentle, uniform manner, without harshly impinging upon the delicate reservoirs which embrace it; and hence the sound is always very different from that of inspiration, being short, feeble, and of a blowing character.

The *bronchial respiration* is entirely free from the crepitation which distinguishes the breathing murmur, and gives the idea of air passing along capacious tubes. In the normal state, it is only heard at the anterior and lateral parts of the neck, except in very thin persons, in whom it may also be perceived towards the top of the sternum, and in the interscapular interval. In the minute bronchial tubes, it is confounded with the respiratory murmur, to such a degree as to render it impossible to discriminate between them.

The number of respirations varies in different individuals, and also in the same person at different periods of life. An adult breathes about eighteen times in a minute; an infant, about thirty-six times. At puberty, the number of respirations is about twenty. In decrepitude the function is performed in a more hurried manner, as well as with less regularity, the intervals between the respirations being at one moment short, and at another long. In general, women breathe a little more frequently than men, and individuals of an irritable temperament, than those who are naturally tranquil or not easily excited. Healthy respiration is effected with ease and freedom, in which there is nearly an equal elevation of the ribs and depression of the diaphragm: each side of the thorax is expanded to the same extent; and there is no sensible difference observable in regard to the intervals of time occupied by the inhalation and expulsion of the air.

II. The pathological phenomena which are displayed in the lungs, may be

arranged under the following heads: 1, acute inflammation; 2, abscess; 3, gangrene; 4, chronic inflammation; 5, œdema; 6, emphysema; 7, apoplexy; 8, encephaloid; 9, melanosis; 10, serous cysts; 11, hydatids; 12, calcareous concretions; 13, hypertrophy; 14, atrophy; 15, tubercular phthisis.

Inflammation of the pulmonary tissue, usually denominated *pneumonitis*, is a very common and fatal disease in cold climates, prevailing not unfrequently epidemically. Commencing with all the symptoms of an ordinary catarrhal affection, it is soon followed by more or less pain in the chest, difficult respiration, and convulsive cough, with expectoration of a thick, ropy mucus, always streaked, in bad cases, with blood. If the patient succumb, as often happens in spite of the best directed efforts of the physician, the anatomical characters will be found to vary according to the extent of the inflammation, its severity, and the length of time it may have existed. In this respect, the disease may be considered as being divisible into three stages, each of which had some features peculiar to itself. In the first stage, the pulmonic tissue is marked by excessive engorgement of blood; in the second, it is dense, and hepatized; and, in the third, it is infiltrated with purulent matter. Each of these pathological states will require brief consideration.

In the first stage of the disease, the inflammation appears to be wholly confined to the parenchymatous texture, the only change observable in the bronchial tubes being the preternatural vascularity of their lining membrane. The lung is externally of a dark, livid color, pits on pressure, and has an unusually heavy and solid feel. With these changes, the natural crepitus and elasticity are impaired; and hence, on opening the chest, the organ seldom completely collapses. The internal structure exhibits various shades of color, from crimson red to livid black, occurring either continuously, in large patches, or in small circumscribed spots, according to the extent of the disease. When cut, blood freely issues from the incision, mixed with white frothy matter; the intervesicular cellular tissue is infiltrated with a large quantity of serosity; and all the vessels, both arteries and veins, are in a state of the utmost engorgement. The lung, in this condition, still floats in water, owing to the fact that it still contains air, and, by careful washing, may be made to resume its spongy, vesicular structure, together with most of its normal characters. In very violent cases, such, for example, as run a very rapid course, we sometimes meet with small sanguineous effusions, traceable to ruptured vessels; and, another effect, which is occasionally wrought in this stage of the disease, is a peculiar softening of the pulmonic tissue, first described by Andral, who regarded it as the result of cadaveric congestion; but which the subsequent observations of Chomel, and other pathologists, have clearly shown to be dependent upon inflammatory irritation. The duration of this stage is usually from one to five days.

In the second stage, the lung is hard and solid, being converted into a heavy, inelastic substance similar to that of the liver. The crepitus, so distinct in the sound state, is no longer perceptible; the organ does not collapse, or only slightly, on opening the chest; and if the affected part be torn across, it will exhibit a large number of granulations, which are nothing but the natural air-cells filled with bloody inspissated lymph. These little bodies are of a spherical shape, closely grouped together, and so solid that, with proper patience, they may be lifted out of their bed. The parenchymatous texture, in this state, is usually of a deep fleshy red, interspersed with various shades of greyish, pink, brown, or even black: it is much more friable than in the preceding stage, breaks readily down under the finger, and is so dry that blood no longer follows the knife that is employed to divide it. By scraping the incised surface, however, or pressing the part between the fingers, a small quantity of

sanguinolent fluid may be obtained, mixed either with thin froth, or, as more frequently happens, with purulent matter. There may also be observed along the incision a considerable number of whitish-looking points and striae, which correspond with unaltered portions of blood-vessels and bronchial tubes. The pulmonic tissue, when thus hepatized, is specifically heavier than water. This stage seldom continues beyond three or four days, when it passes into purulent infiltration.

We have just seen that the color of a hepatized lung is liable to considerable variation. This is owing altogether to the nature of the effused fluids on which the solidification depends. When the product consists simply of plastic lymph, the hepatized part is generally of a greyish white; but, when this substance is blended with hematosine, as it commonly is when the inflammatory irritation runs high, the color is always more or less red.

In the third stage, the lung, although it exhibits the same or even a greater degree of hardness, and the same granular structure, as in the second, assumes a pale yellowish cast, variegated with hepatized patches of red, grey, or even bluish. Pus always exists in this state, appearing at first in small isolated points, but which in a short time coalesce, and thus impart to the pulmonic tissue a uniform citron color. If an incision be made into the lung, it will be followed by the escape of an opaque, ropy fluid, evidently of a purulent nature, but almost void of smell, or at least much less offensive than the matter of an external wound. As might be expected, from what has been just stated, the parenchymatous structure is extremely moist, soft, and lacerable, the slightest pressure of the finger converting it into a yellowish, pulpy mass. The smaller bronchial tubes, in the third stage of pneumonitis, are completely obstructed; the larger ones, on the contrary, contain more or less purulent matter, and their mucous lining is thickened, injected, and of a brownish red color.

The anatomical characters of the three stages here described frequently occur in the same lung, dividing it into so many zones, which gradually and insensibly run into each other. Much diversity prevails in regard to the extent of the disease. In a few instances, I have seen it occupy almost the whole lung; most generally, however, it affects only a single lobe, or small detached masses. We never find the whole of both these organs hepatized at the same time, for the obvious reason that an obstruction of this kind would be incompatible with the respiratory function. The right lung, according to Laennec, is more frequently involved than the left, not only in pneumonitis, but in nearly all the morbid affections to which these delicate structures are liable. This view is strikingly confirmed by the interesting investigations of Dr. Lombard, of Geneva. Uniting all the cases collected by Chomel, Andral, and himself, he ascertained that, in nine hundred and sixty-eight patients, one hundred and ninety-five had the disease in both lungs, two hundred and sixty in the left, and four hundred and thirteen, in the right.\* Various explanations have been proposed of this fact; the most plausible hypothesis, perhaps, is that of Lombard, who supposes that the difference in the size of the pulmonary arteries will account for the circumstance. But it may well be doubted, I think, whether the right lung receives more blood, in proportion to its volume, than the left: the question, at all events, remains undetermined; and, until something positive be known, it will be well enough to refrain from conjecture.

Pneumonitis is a very common disease in children under six years of age; it attacks boys more frequently than girls, and usually occupies the lobules instead of the lobes, as it almost always does in older subjects. Hence the

\* American Journal of the Medical Sciences, vol. ix., p. 202.



term *lobular*, by which it is generally designated by pathologists. In the adult it may occur as an idiopathic affection, but in a great majority of cases it is ingrafted upon whooping-cough, bronchitis, croup, typhoid fever, measles, scarlatina, and gangrene of the mouth. It may begin at a single point, or simultaneously at several, and in its progress involve an entire lobe, or the greater part of one entire lung. It is ordinarily double. The most frequent complications of infantile pneumonia are, dilatation of the bronchial tubes, emphysema, especially the vesicular variety, pleuritis, and inflammation of the bronchial lymphatic ganglions.

The disease, anatomically considered, may be divided into three stages. In the first, the affected part has a marble, red, or rosy-grey complexion; and is somewhat softer, or a little less firm, than in the healthy state; it floats in water, crepitates under the finger, and emits, when pressed, a thin, frothy fluid. In the second stage, the pulmonary tissue is of a deeper color, reddish-grey, violet, or purple, generally well-circumscribed, solid, knotty, almost incompressible, and indisposed to collapse on opening the chest. The affected part, which often comprises from three to five lobules, is of the size of an almond, or a small walnut, and usually of a rounded shape, though sometimes it is elongated, ovoidal, or polyhedral; the mass is easily penetrated by the finger, sinks in water, exhibits a rough granulated appearance on being torn, and is saturated with a sanious, aerated fluid. In the third stage, the diseased structure is of a greyish, or yellowish color, friable, and infiltrated with globules of pus; it bears, in fact, a very close resemblance to grey hepatization; when cut, the part has a shining homogeneous aspect; the vessels are still visible, as white lines; and the bronchial tubes, although much compressed, may be traced with a little care. The lining membrane of the tubes may preserve its white, transparent appearance; but in general it is abnormally red, and bedewed with an abundant mucous fluid. When the inflammation is very intense, or spread over an unusually large surface, the secretion is sometimes puriform, or even purulent.

Rilliet and Barthez have described two forms of lobular pneumonia, the *mammillated*, and the *partial*. The first, which occurs with equal frequency in all parts of the lung, as well as on both sides, is perfectly isolated, and situated in the midst of healthy or nearly healthy tissue; the boundary is usually very neatly defined, even when the surrounding substance is engorged, and is sometimes established by a narrow band of false membrane, scarcely a fourth of a line thick, of a white color, and of a fibrous texture. The size of the hepatized spots varies from a hemp-seed to a pigeon's egg; their number is from one to twenty or thirty; and their form is generally more or less spherical.

The partial variety of lobular pneumonia is more common on the left side than on the right, and in the inferior than in the superior lobes, though it is often disseminated through the entire lung. The engorged patch, instead of being perfectly circumscribed, as in the mammillated form, is insensibly lost in the surrounding tissues; its volume is generally greater; its shape is more irregular; and the inflammation extends in different directions, so as to involve a considerable number of neighboring lobules, or even an entire lobe. Hence this form of the disease has frequently been confounded by pathologists with lobar pneumonia.

It is not often that the pneumonia of children terminates in the formation of abscesses. When this takes place the pus is of a thick, cream-like consistence, and of a yellowish or greenish-yellow color, non-aerated, and perfectly free from odor; sometimes it is thin and reddish; and in a small proportion of cases it is mingled with clots of blood, or flakes of fibrin. The abscesses vary in size

from that of a millet-seed to that of a pea ; there may be only one, or they may be so numerous that they cannot be counted ; they are generally round, or slightly oval ; and they are found in the centre of the lung, as well as at the surface ; to the latter of which they ordinarily tend. In recent cases the matter is immediately surrounded by a layer of hepatized pulmonary tissue ; in those of old standing, on the contrary, it is occasionally enclosed by a false membrane, thin, smooth, and polished, or by a small quantity of concrete pus, or broken down lymph. When several abscesses coexist they sometimes coalesce, and thus form a considerable-sized cavity, either single, or multilobular. The matter is either absorbed, or it bursts into a bronchial tube, and is finally expectorated. When it is situated near the surface of the lung, it may erode the pulmonary pleura, and so escape into the thoracic cavity. This, however, is exceedingly rare.

A peculiar state of the pulmonary tissue to which pathologists have recently applied the name of *carnification* may be briefly noticed here. How it is produced is not determined, but the probability is that it is merely one of the effects of pneumonia. It attacks both lungs indiscriminately, and usually occupies their lower base. The affected part closely resembles a muscle, the fibres of which are compressed and indistinct ; it is hard, dense, and resisting, instead of being soft, flaccid, and friable, as in ordinary cases ; it is non-crepitant, and is penetrated with difficulty by the finger ; the cut surface exhibits a smooth appearance ; and when pressed it yields a small quantity of sanious, bloody fluid. Its color is violet, rose, or pale red, and mottled with white radiating lines, which are disposed in the form of lozenges, and indicate the situation of the lobules. The lung itself has a remarkably depressed appearance, similar to what is observed in an imperfectly inflated fœtal lung, so well described by Jörg, under the name of *atelectasis pulmonum*.

The different lesions of pneumonitis are accompanied by appropriate symptoms, which indicate their presence, progress, and mode of termination. In the first stage, when the pulmonie tissue is infiltrated with bloody serum, all the vessels are in a state of engorgement. The characteristic manifestations are, hurried respiration, dyspnœa, obtuse pain in the chest, distressing cough, and inflammatory fever. The lung being still permeated by the atmosphere, the chest, on percussion, yields pretty much the same sound as in health ; though, if the disease occupy a large extent of surface, it will often want its natural clearness. If the ear be applied, a peculiar sound, accompanying the usual respiratory murmur, will be heard : it is a fine, crackling noise, resembling that which results from rubbing a lock of hair between the fingers, and is regarded, by most pathologists, as pathognomonic of the first stage of this disease. This sound, it may now be observed, is called the *crepitating rhonchus*. It is always more distinct in proportion to the extent of the engorgement, and is most easily recognized at the lower part of the chest, beneath the axilla, and in the interval between the scapula and spinal column. The expectoration, in this stage, is white, frothy, and small in quantity, — at first thin and transparent, afterwards remarkably viscid, and often streaked with blood.

In the second stage, in which the pulmonic tissue is hepatized, and consequently impervious to the air, the chest over the inflamed lung is dull on percussion ; and, instead of the crepitating rhonchus, there is a singular whiffing sound, not unlike that which is produced by blowing through a narrow quill. This is the *bronchial respiration* of Laennec and Andral, which is always more audible in proportion to the solidification of the parenchymatous structure. It seems to be caused by the force with which the air is impelled against the walls of the obstructed bronchial tubes, and is usually most perfect at the

root of the lungs, where it is occasionally so loud as almost to amount to a whistle. The earliest indications of its presence are to be detected a little above the centre of the dorsal region, between the spine and scapula. Laennec, not knowing that this sound uniformly exists in this stage of pneumonitis, was disposed to undervalue it as a diagnostic sign ; but, at present, it is universally regarded by practitioners as the most important character which, in this respect, we possess.

As usually coexisting with this altered state of the respiratory function, it will be necessary here briefly to advert to that peculiar resonance of the voice which writers have distinguished by the term *bronchophony*. It does not occur in distinct words, but in notes of various continuance, resounding, at the end of the stethoscope, as if they came through little tubes. Always loudest towards the root of the lungs, it is sometimes characterized by a curious, vibrating tone, from the complication of pleuritic effusion, which so often occurs in combination with this disease. Like bronchial respiration, it is more distinct in pneumonitis than in any other affection, and hence is occasionally of much value in determining the diagnosis.

The expectoration, in this stage, is still scanty, often not exceeding a few ounces in the twenty-four hours. The cough is hard, and the sputa, which are slightly yellowish, and semi-transparent, are remarkably tenacious, streaked with red, and blended with small air-bubbles. After a while, the red streaks disappear, and the whole mass acquires a peculiar rusty color, which, as it occurs in no other disease, may be considered as absolutely pathognomonic of acute pneumonitis. This tint arises from the intimate manner in which the blood is incorporated with the ropy mucus of the bronchial tubes.

In the third stage, the bronchial respiration ceases, being replaced by a coarse *mucous rhonchus*, which is always loudest at the root of the lungs, in the axillary region, and below the great pectoral muscle. The chest offers the same flatness, on percussion, as in the second stage, and there is also the same want of respiratory murmur. The expectoration is more easy and abundant, and the sputa, which are commonly of a yellowish hue, are of a muco-purulent character : they are not so tenacious as before, and frequently sink in water. In some instances, they are thin, homogeneous, and brownish, like the juice of prunes : this, however, is an occurrence of great rarity, and always portends danger.

Considerable variety obtains in relation to the *pain* which the patient experiences in this disease. In pure, uncomplicated pneumonitis, it is generally of a dull, aching character, and sometimes it is even entirely absent. In a man, aged forty, whom I attended, about eighteen months ago, with my friend Dr. Woodward, there was not the slightest manifestation of pain throughout the whole course of the disease, a period of upwards of three weeks ; and yet, upon examination, both lungs were found greatly disorganized, being almost universally engorged, with several of the lobes in a state of purulent infiltration. For the most part, however, the disease occurs in connection with pleuritis ; and then the pain is often very distressing, sharp and lancinating, shooting from the affected structure towards the shoulder, the axilla, and corresponding arm.

The *respiration* in pneumonitis is performed chiefly by the diaphragm, and is therefore short, hurried, and painful : the frequency, on an average, is about twenty-five ; but, in very severe cases, it often ranges as high as thirty-five, forty-five, or even fifty in a minute. The cough is at first dry and convulsive ; in the latter stages of the disease, it becomes moist and less harassing, though it is still somewhat painful, especially in children. The patient lies almost



always on his back, seldom or never on the affected side. The prostration of strength is usually great and rapid.

Pneumonitis occurs at all periods of life, from the cradle to the grave. Occasionally, indeed, it exists as an intra-uterine disease.\* It is incomparably more frequent, however, in infancy and in old age than in the prime of life or vigor of manhood. In the winter of 1836-7, when this disease betrayed somewhat of an epidemic tendency in Cincinnati, the greatest number of persons affected, by far, were children under three years of age. In London, Paris, and other European cities, during the same season, it appears to have been remarkably destructive to old people.

The disease ordinarily begins in the inferior parts of the lung, from whence it radiates in different directions, until it involves a greater or less extent of tissue. This statement accords with that of Laennec, and many of the best authorities of the present day; but it is opposed to the results of the observations of Broussais, Chomel, and several other highly respectable pathologists. In fifty-nine cases, Chomel found the upper lobes affected in thirteen; the inferior, in eleven; the whole of one lung, in thirty-one; the posterior parts, in two; and the middle, in one.† The universality of this occurrence, on the whole, is perhaps not so great as was imagined by Laennec: still, I feel perfectly satisfied, both from my own, and the observations of others, that his statement is applicable to the great majority of cases of this complaint, whether occurring in old age, in infancy, or in youth.

Pneumonitis frequently terminates in *resolution*, especially when it does not transcend the second stage. When this event is about to take place, the preternatural vascularity gradually disappears, the effused fluids are absorbed, and the air-cells regain their primordial volume and figure. Sometimes the pulmonic texture continues for a while to be œdematous, being characterized by slight dulness on percussion, and indistinctness of the respiratory murmur. The progress of a portion of hepatized lung is more tardy, a considerable period generally elapsing before the granulations give way to the development of the air-filled vesicles. The first perceptible change is a diminution of color, accompanied by an absorption of the lymph which gave rise to the solidification. As the process advances, the pulmonic tissue becomes gradually more yielding and elastic, it loses its dryness, fragility, and is infiltrated with a thin serous fluid, characters which closely assimilate it to the normal texture. In the third stage, resolution is a rare occurrence; but, should this take place, the yellow color may be supposed to become lighter, and the pus more liquid from the admixture of serum. Air vesicles afterwards appear, and continue to increase, while the purulent fluid is reduced to small points, which progressively diminish in number as the vesicular structure returns. All these changes, as might be supposed, are accompanied by corresponding changes in the physical signs of this disease.

The formation of *abscesses*, as an effect of pneumonitis, is extremely rare. Laennec states that, in several hundred examinations of persons who died of this disease, he never met with more than five or six cases in which the pus was concentrated into a focus. Precisely of the same import is the testimony of the latest pathological anatomists of Europe and this country. Broussais declares that he has met with this termination only once; Andral and Louis also consider it as very infrequent; and Dr. Horner, who states that he has dissected more than fifteen hundred bodies, has observed it only in two in-

\* Cogny, Dissertation sur la Pneumonie, &c. des Nouveau-nés. Paris, 1827.

† Laennec on the Chest, p. 204, note, by Dr. Forbes.

stances.\* In my own examinations, I have not been more fortunate, having hitherto seen pulmonic abscesses only in two persons, the one an adult, aged forty, the other a child of fifteen months. In this case, the abscesses, which occupied the inferior lobe of the right lung, were about twenty in number, the largest of which scarcely equalled a cherry-stone. No tubercles were found: the child had been sick about four weeks.

Formerly the termination of pneumonitis by abscess was considered as very frequent,—an error which no doubt arose from mistaking tubercular excavations, which are of such common occurrence in consumptive subjects, for collections of this kind. Of this, any one may convince himself by a careful perusal of the works of Bonetus, Morgagni, and other pathologists of the seventeenth and eighteenth centuries. Even Dr. Baillie, so justly distinguished for the accuracy with which he generally conducted his researches, did not escape this error.† The reason of the infrequency of this mode of termination of pneumonitis will be explained by and by.

The walls of these abscesses are formed by the pulmonic tissue, which is usually infiltrated with pus, and in a state of putrilaginous softening. In one of the cases to which I before referred, the matter was bounded by a dark, flesh-colored substance, very considerably indurated. Occasionally, the abscesses are encysted, or enclosed by a thick, false membrane: cases of this kind, however, are very rare, and I have never met with them. Their size varies infinitely: in a few instances, they have been found as large as an adult fist; but, in general, they do not exceed a nutmeg, hickory-nut, or small apple. Frequently they communicate with the bronchial tubes, through which the matter is at length discharged, when the cavity heals, and the individual recovers; the mode of cicatrization being in every respect analogous to that which takes place in the spontaneous cure of a tubercular excavation. In old cases, the pus is usually of a thick, creamy nature; in recent ones, on the contrary, it is apt to be semi-concrete, from the admixture of an undue proportion of lymph. The purulent depositions are commonly seated near the surface of the lung, seldom deep in their structure.

Abscesses of the lungs can occur only in association with, or as a consequence of, inflammation, whose limits are properly circumscribed; in other words, the disease must be confined to particular parts, lobes, or lobules. The rationale of this is obvious. In universal pneumonitis, death must necessarily ensue before the matter can break up the cellular tissue and collect itself into a focus; which need not be the case when the inflammation is limited, nature, properly assisted by art, being often capable here of warding off this occurrence until after the establishment of the suppurative process. Abscesses sometimes form in the substance of the lungs, as in that of the liver, in consequence of severe wounds and great surgical operations. Their origin here, whatever it may be, is probably the same as in the latter organ. I cannot think, with Andral, that the pus is formed in the remote veins, and filtered into the pulmonic tissue in its passage through the lesser circulation. Such an event may occur occasionally; but to suppose that it happens generally, or even frequently, seems to me to be repugnant to the laws of sound pathology.

Of the constitutional symptoms of pulmonic abscess, nothing need be said in this place. As to the physical indications, they do not differ from those which appertain to the third stage of pneumonitis, until the purulent matter has been partly expectorated. In that case, the bronchophony is replaced by a peculiar *gurgling rhonchus*, which becomes more and more hollow in propor-

\* Pathological Anatomy, p. 241.

† Morbid Anatomy, p. 42.

tion to the evacuation of the liquid contents of the abscess, the voice, if the stethoscope be applied over the cavity, seeming to issue directly from the chest of the patient. This is the *pectoriloquous* respiration of Laennec and other writers. When the cavity is very large, a *metallic tinkling* is sometimes heard, resulting from a mixture of air, pus, and mucus, in the same way as this phenomenon is developed in tubercular excavations.

*Metastatic abscesses* of the lungs are generally produced by wounds of the head, comminuted fractures of the extremities, and great surgical operations; they may also arise from burns and scalds, erysipelas, small-pox, and other violent diseases. Their number is exceedingly variable; sometimes there is only one; at other times there are as many as six or a dozen; and occasionally, though rarely, there are several hundred. In their volume they may be as small as a mustard-seed, or as large as a pigeon's egg. They are of a rounded shape, distinctly circumscribed, superficial, and nearly always most numerous in the inferior portion of the lungs. Their contents are of a tough, fibrinous consistence, and of a reddish, brownish, or blackish color. The pulmonary tissue around them is unnaturally vascular, œdematous, hepatized, and friable: the smaller veins are inflamed, and filled with black or reddish concretions. The insidious manner in which these abscesses are developed has been a common remark among pathologists. They are liable to be confounded with pulmonary tubercles, but may be readily distinguished from them by their larger size, by their darker color, and by the fact of their being usually the result of a distant lesion.

The lungs are liable to become *gangrenous*, sometimes as an effect of acute pneumonitis, but more generally without any assignable cause. The disease may occur in circumscribed spots, or it may invade an entire lobe, or even the whole of one of these organs. It may be readily detected by its intensely fetid odor, and by its greenish brown, dirty olive, dark brown, or black color. The pulmonic tissue is softened, and converted into an offensive putrilaginous mass, not unlike decomposed blood. When cut, the part affected often gives vent to a turbid, sanious fluid, of a greenish tint, and an almost insupportable smell: in rare cases, the sphacelated mass is dry and friable, like a rotten pear. When the gangrene is circumscribed, an imperfect factitious membrane may sometimes be discovered; but, in most instances, where there is a distinct line of demarcation, the living part is preternaturally injected and infiltrated with sanguinolent liquid, with cellular shreds and vascular filaments hanging from its borders. By degrees, the putrid pulp finds its way into the adjoining bronchial tubes, and is finally ejected by expectoration. The cavity which is thus left, is either filled up with lymph, or, as more commonly happens, its walls are lined by a false membrane, which continues to secrete, for a time, a thin, imperfect pus.

Laennec, who considers this disease as altogether of an idiopathic nature, like hospital gangrene, seems disposed to look upon it rather as exciting than following pulmonic inflammation. This opinion is partly correct, partly erroneous; for it is now well ascertained that sphacelus is generally a result of inflammatory irritation, more or less intense in its character, though not always offering the usual evidence.

Gangrene of the lungs is of much more frequent occurrence than was formerly supposed by pathologists. Dr. Gerhard\* informs us that, in a single winter, he saw six cases of it in the Philadelphia Almshouse; and, in the same year, the disease, it would appear, was extremely common in Paris. It

\* On the Diagnosis of the Diseases of the Chest, p. 99.



is most prevalent in cold weather, and occasionally betrays an epidemic tendency. It makes its attacks at all periods of life ; but the aged, and especially such as are of intemperate habits, are most prone to it. A singular fact respecting gangrene of the lungs has been recently witnessed by Dr. Guislain, a French physician. Out of thirteen insane patients who died of inanition in the hospital at Gand, nine were affected with this disease. In one case, both lungs were involved ; and in nearly all of them the sphacelation was confined to the posterior and upper part of these organs.\* How is this occurrence to be explained ? The present state of our knowledge does not enable us to give a satisfactory answer.

The only two specimens of gangrenous lung that I have ever seen are preserved in my private collection. Of these, one belongs to the circumscribed variety, and was taken from a mechanic, forty years old, who died in Cincinnati in September, 1835, having had, six weeks before, an attack of confluent small-pox. During the latter part of his illness, he was attended by Dr. Wood, who describes his symptoms as having consisted in severe thoracic pains, distressing cough, recurring in irregular paroxysms, and expectoration of large quantities of dark-colored, bloody mucus. He expired in about a week after. On inspection, I found the left lung, at the part corresponding with the interlobular fissure, reduced, for about one inch in diameter, to a dark, pulpy, gangrenous mass, so excessively offensive, that it was almost impossible to remain in the apartment where we were conducting the examination. The eschar, which reached as far as the surface of the lung, communicated with a large bronchial tube, and had been discharged in part by expectoration. The pleura immediately over it was in a state of sphacelation, and the matter was evidently prevented from escaping into the chest by the adhesions which the lung had formed with the wall of that cavity. The pulmonic tissue round the gangrene was rather soft and injected, and the whole surface of the organ was covered with a false membrane, thick, dense, and highly vascular.

In the other specimen which belongs to the diffuse variety, the gangrene involved nearly the whole of the right lung, which was of a dark, dirty olive color, extremely soft and friable, and exhaled a most intolerable odor. The pulmonary pleura was perforated in several places, and a considerable quantity of black, offensive matter was found in the corresponding cavity of the chest. The disease, in this case, supervened upon an attack of typhoid fever, and was marked by a brownish, fetid expectoration, which set in a few days before death. The patient was a young printer, about twenty-three years of age.

The progress of this disease, if at all extensive, is generally rapid ; the respiration is much embarrassed ; the cough excessively distressing ; and the patient often expires in a state of asphyxia. The expectoration, which is of a dirty black, green or brown color, is so horribly offensive, that it may be considered as pathognomonic of the disease. In case the slough is detached, the same signs of a cavity may be produced, as in abscess of the lungs, already described.

*Chronic pneumonitis* may be a sequel of the acute disease ; but, in the great majority of cases, it seems to have a primary and independent existence. Some still doubt whether there is such an affection as chronic inflammation of the lungs ; and it must be confessed that, at first sight, the skepticism is not without some degree of plausibility. The older writers are entirely silent on the subject, nor do we find any satisfactory information concerning it until the time of Laennec, who investigated it with his accustomed patience and accuracy.

\* Gazette Médicale de Paris, January, 1836.

He considers the disease as extremely infrequent,\* an opinion in which he has since been joined by many of the most distinguished pathologists of the French school. Chomel asserts that, although he has annually, for the last sixteen years, examined about two hundred bodies, he has seen only two well-marked examples of it.† Andral and Louis also consider it as very rare; and of the same nature, precisely, is the testimony of some of the most experienced British pathologists. What the sentiment is on this point of American physicians, I am not informed, as I have no means of ascertaining it; and as for myself, although I have in a few instances witnessed the disease, or rather its structural effects, my observations are too limited to enable me to draw any general deductions.

A chronically inflamed lung is hard, dense, and dry, yielding little or no moisture on pressure; it tears with a granulated surface, pits under the finger, and cuts a good deal like a sponge. Here and there a reticulated structure, caused by some remains of the air-cells, is visible; and, scattered through various parts of it, numerous tubercles may sometimes be observed, of a pale greyish hue, semi-concrete, and easily removable. The color of the indurated organ, being altogether of an accidental character, varies in different cases. Thus, it may be red, greyish, pale yellow, iron grey, brownish, or even black, or these tints may be blended, and so the part have a mottled aspect. In the College Museum is a specimen of the color of flesh; and another which is of a light greyish hue beautifully dappled with black. These, together with a specimen taken from a young horse that died of pneumonitis, complicated with chronic pleuritis, are the only instances, so far as I now recollect, which I have seen of this affection. In neither of them were there any tubercles. The pulmonary tissue in all was remarkably dry, hard, tough, smooth, and shining when incised, rough and granular when torn. The bronchial tubes seemed to have been entirely closed: many of the larger vessels were filled with red, clotted, friable blood, and the smaller ones were either obliterated, or so incorporated with the indurated mass as to have lost completely their original features.

The disease may be limited to a few lobules; but in general it affects one or more lobes, and sometimes one entire lung. It is occasionally observed around pulmonary abscesses, and very commonly around tubercular excavations. The indurated part is usually much diminished in volume, and does not, according to my own observation, sink so readily in water as in the acute form of the lesion. The two specimens above alluded to, notwithstanding the induration was very great, were both specifically lighter than this fluid.

Chronic pneumonia may pass into purulent infiltration, abscess, and even gangrene. When fully formed, it is doubtful, I think, whether it is susceptible of resolution, since the various textures are so firmly cemented together by lymph as to render it impossible for the absorbents to effect their restoration. When idiopathic, the progress of the affection is gradual, exciting little attention until a large portion of the pulmonary tissue has become impermeable to the air. Often there is very little pain, cough, or dyspnœa. The chest sounds dull on percussion, and there is always a mucous rhonchus, with occasional bronchial respiration.

The lungs are occasionally the seat of *œdema*, — a disease, which, as its name imports, consists in an effusion of serum into their cellular texture. The

\* "I am acquainted," says Laennec, "with only a small number of cases which can be considered as examples of chronic peripneumony; and they are extremely rare." (Treatise on the Chest, p. 238.)

† Dict. de Med., t. xvii., p. 252.

anatomical characters vary according as the lesion affects either the whole or only a part of the respiratory organs. When the entire lung is involved, it does not collapse on opening the chest: it is denser and heavier than in the normal state; pits on pressure; and, when cut, exudes a large quantity of clear, yellowish serosity. This fluid is intimately blended with the interstitial cellular tissue of the organ, into which it is originally deposited, and can be easily discriminated from that which is diffused during the first stage of pneumonitis, by its being less frothy, and of a lighter complexion. The lung, when thus affected, still crepitates on pressure.

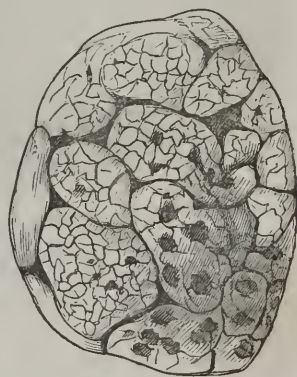
This disease, although of very common occurrence, does not seem to have received much attention from the profession until the time of Laennec, to whom thoracic pathology is under so many obligations. Rarely is it idiopathic: on the contrary, it is usually associated with other dropsical disorders, occurring, for the most part, in worn-out cachectic individuals towards the close of painful and protracted fevers. Sometimes it accompanies organic affections of the heart. Chronic bronchitis likewise predisposes to it; and it is the cause of the embarrassment of breathing which so often exists as a sequel of measles, small-pox, and scarlet fever. The œdema seldom lasts beyond a few days; occasionally, however, it continues for several weeks or even months, when the fluid is either absorbed, or the case proceeds to a fatal termination.

There are no physical signs which can be considered as positively indicating the presence of this state of the lungs. The sound, on percussion, is nearly as clear as in health; but the respiratory murmur is, in most cases, very much diminished. A crepitating rhonchus, most distinct at the base of the lungs, is usually perceived, resembling a good deal the sound of effervescing champagne. The respiration is impeded; there is slight cough; and the expectoration is thin and scanty.

Of *emphysema* there are two varieties — the vesicular and the interlobular — the one consisting in a dilatation of the pulmonic cells, the other in the extravasation of air into the interstitial cellular tissue. These two forms seldom coexist; and the latter, compared with the former, is usually regarded, though erroneously, as a most rare disease.

In the *vesicular emphysema* (Fig. 123), the air-cells are preternaturally dilated, and distorted in shape. Their size varies in different cases. In the great majority of subjects, they equal in magnitude the head of a common pin; in others, they are as large as a currant; in others, again, as big as a cherry-stone, or even a French bean. When the cells are of the latter dimensions, which, however, is a very rare occurrence, it is not improbable that several of them are thrown into one, by the rupture of the intervening texture: in some instances, notwithstanding, the enlargement evidently results from a single vesicle, the walls of which, instead of yielding to the distending cause, are expanded into thin, transparent bags. Occasionally, all the cells disappear from one entire lobule, leaving merely some vascular and cellular shreds. In this manner a capacious cavern is sometimes produced, which projects beyond the surface of the lung, in the form of one or more globules.

Fig. 123.





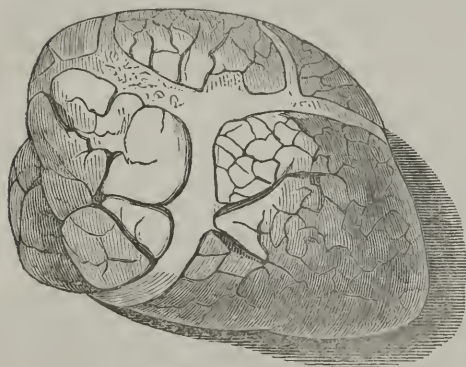
The lung, in this variety of the disease, seems to be augmented in volume, and to have lost its natural resiliency. It is considerably paler than the sound organ, less crepitous, more dry and elastic, and does not collapse on opening the chest. Its specific gravity, also, is increased; the surface is often studded with small vesicles; and many of the minute bronchial tubes are in a state of dilatation.

Vesicular emphysema is rarely observed before the age of fifty. It may exist in both lungs at the same time, or it may be limited to one of these organs, to one lobe, or even to a small portion of a lobe. In eighteen cases out of forty-two, observed by Louis, it was found general throughout both lungs. It is a very common attendant on tubercles, aneurismal tumors of the heart and aorta, enlargements of the bronchial glands, and asthmatic disorders. Amongst the occasional causes may be enumerated whatever has a tendency to over-distend the air-cells of the lungs, as playing upon wind instruments, singing, and loud screaming.

The principal signs of the disease are, habitual dyspnoea; shortness of breathing; slight cough, either dry, or attended with a thin, frothy expectoration, mixed with more or less mucus; absence of the ordinary respiratory murmur; and a loud drum-like sound on percussion. When the emphysema is very extensive, the lung may be so much augmented in bulk as to encroach very sensibly upon the heart and mediastinum, — forcing down the diaphragm, elevating the intercostal spaces, and giving the chest a vaulted appearance contrasting singularly with its naturally compressed shape. So remarkable is this conformation, under certain circumstances, that, according to Laennec,\* we may often with certainty announce the existence of pulmonic emphysema from simple inspection.

The second variety, or *interlobular* emphysema (Fig. 124), consists,

Fig. 124.



as was before stated, in the diffusion of air through the interareolar texture, in consequence of the rupture of some of the pulmonary vesicles. Of this lesion, I have observed a considerable number of cases, and am disposed to believe that it is quite common in our Western States. So far as an opportunity has been afforded me of judging, no period of life, I should say, is wholly exempt from it. Males, between twenty and thirty, have appeared to me to be particularly subject to it, much more so than at an earlier or later age, or than the other sex. I have

never observed this affection in new-born infants; but, in one instance, I noticed it in a child of seven months, who died under symptoms of pneumonitis, complicated with hydrocephalus. Of nineteen cases of this disease, of which I have kept a record, six occurred in association with bilious and typhoid fever, four with dysentery, three with whooping-cough, one with acute inflammation of the lungs, four with tubercular phthisis, and one with infantile cholera.

In twelve of these cases, the emphysema affected both organs, though not

\* Treatise on the Diseases of the Chest, p. 162.

to the same extent. In five it was exclusively confined to the right lung, in two to the left. In nearly all, it was most distinctly marked along the interlobular intervals and the free margins. In a few only was it noticed at the base of the organ, and in not a single one at the apex, or at the posterior part of the internal surface. Why these differences should obtain, or, in other words, why certain portions of the lungs should be more frequently affected in this way than others, are circumstances in the history of this lesion which, in the present state of the science, we are totally incompetent to explain.

When a lung is thus affected, the diseased part is easily recognized by its peculiar whitish appearance, which contrasts singularly with the red-colored textures around it. It distinctly crepitates under the pressure of the finger, the contained air being readily pushed from one place to another, and the serous covering of the viscus appears, as in truth it is, to be lifted off from the parenchymatous substance. In this way, I have repeatedly known thin, flattened bags to be formed from two to three inches in length, by six or eight lines in breadth, and as perfectly pellucid as the most delicate soap bubble. In other instances, the pleura is raised into little globules, so closely clustered together as to bear a strong resemblance to a string of pearls. But whatever may be the form or extent of the elevation, the parenchymatous texture beneath is always more or less lacerated, of a pale color, and generally reduced, especially in cases of long standing, to a sort of network, consisting solely of vascular and bronchial ramifications. These are generally arranged in transparent bluish bands, as in Fig. 124.

In this, as in the preceding variety, the lungs do not collapse on opening the chest, and they also cover, to an unnatural extent, the surface of the pericardium, which, especially when the emphysema is very great along the anterior margins of both viscera, is sometimes almost entirely concealed. Occasionally, the air escapes into the cellular substance of the mediastinal cavity, where it is either arrested, or it extends up the neck, and forms an irregularly flattened tumor, which sensibly crepitates on pressure. In this way, the fluid may reach over the whole body.

In this species of emphysema, the chest emits a loud noise on percussion; the respiration is much embarrassed; and the ear detects a dry, crepitating rhonchus, with large bubbles, which, in connection with the sudden supervention of dyspnœa, upon any violent effort of the lungs, is the pathognomonic sign of the disease. Sometimes, as before intimated, the air escapes into the mediastinal cavity, and thence spreads over the cellular tissue of the neck and upper extremities. When this happens, all doubt as to the true nature of the complaint must of course vanish. The most frequent cause of interlobular emphysema is the forcible and prolonged retention of the air during severe muscular efforts, as in lifting heavy weights, in parturition, in whooping-cough, croup, and other affections of the respiratory passages.

Like the disease which we have just been considering, *pulmonary apoplexy* may be distinguished into two varieties — the vesicular and the interlobular — the blood in the one being retained in the air-cells, in the other, extravasated into the connecting cellular tissue. The lesion, although incidentally noticed by Haller, and other writers of the last century, was first accurately portrayed by Dr. Hohntaum, of Erlangen, in 1817. A few years subsequently, a more detailed account of it was published by Laennec; and, since that period, it has been ably described by other pathologists, both in France, England and Germany.

As might be expected, the anatomical characters of pulmonary apoplexy vary, as the fluid occupies the vesicular or the interstitial cellular texture. In

the former case, the blood is collected into round circumscribed masses, from the size of a pea to that of a large apple. When incised, the section has a deep red, granular aspect, of the consistence of a hepatized lung, with numerous intersecting vessels and tubes of a much lighter color. By scraping with the handle of the scalpel, the clotted blood is removed from the air-cells, and the part exhibits a beautiful honey-comb arrangement, the pits being separated by irregular partitions.

In the second variety, the fluid ruptures the air-vesicles and is extravasated into the intervening cellular tissue, breaking it down into a ragged, shreddy substance, in appearance not unlike a coarse sponge, saturated with dark blood. Large cells and excavations may be thus formed, penetrating to a considerable depth, and converting the lung, in some cases, into a soft, irregular, fluctuating mass. Occasionally, the apoplectic effusion is so great as to lacerate the pleura, and escape into the thoracic cavity. This, however, is rare; and I have never witnessed an example of it; nor are there, so far as is known to me, more than five or six instances of the kind on record.

When the effusion is very profuse, as often happens when it proceeds from a ruptured vessel of considerable magnitude, death sometimes occurs in a few hours, — occasionally, indeed, almost instantaneously. In other cases, the blood is discharged by the mouth, or a portion of it remains, and gradually assumes new properties. If the individual is cut off during the attack, the blood is found, upon inspection, to be of a dark venous hue, and only partially or not at all coagulated. In cases of an opposite character, however, it is uniformly clotted, more or less firm, and of a light brownish, pale, gray, dun, or drab color. These alterations are always more conspicuous in proportion to the length of time that has elapsed since the apoplectic attack, and, it need scarcely be said, are dependent upon the absorption of the serum and coloring matter of the extravasated fluid.

The tissue around the clot may be quite sound and crepitous, but is more commonly pale and indurated. Sometimes the clot acts as a foreign body, producing inflammation, softening, suppuration, or even gangrene. Should the effusion be small, limited in extent, or not have caused much injury, it may be entirely absorbed, and the vesicular structure resume its normal characters. In other cases, again, though this is extremely rare, nature makes an effort at reparation by organizing the clot, or enclosing it within a cyst of false membrane, as in apoplexy of the brain.

The blood, in pulmonary apoplexy, may flow from two distinct sources, either from the mucous membrane of the bronchiæ, as a simple exhalation, or directly from a lacerated vessel. When depending upon the latter source, the hemorrhage is often extremely profuse, and proves rapidly fatal. Several years ago, I examined the body of a man, thirty-two years old, who died about twelve hours after an attack of pulmonary apoplexy, in which he must have lost nearly a gallon and a half of blood. The stomach contained nearly a quart of this fluid; the bronchiæ, trachea, and larynx were nearly filled with it; and a large tubercular excavation in the upper lobe of the right lung, capable of holding five ounces, and from which the hemorrhage proceeded, was also occupied with it. A loss of blood, of five or six pounds, is by no means unusual in seizures of this kind.

Much dispute existed, at one time, concerning the probability of this disease emanating from simple exhalation of the mucous membrane of the bronchial tubes. The subject is amply discussed by Bichat, who espoused the affirmative side of the question; and his opinion has been abundantly confirmed by the more elaborate researches of modern pathological anatomists. It is now,



indeed, well ascertained, that the occurrence is not only possible, but much more frequent than is generally imagined. The hemorrhage, though sometimes profuse, is seldom so great as when it proceeds from a ruptured vessel.

Hypertrophy of the right ventricle of the heart, with contraction of the mitral valves, seems to be the most frequent cause of this lesion. In the cases examined by Dr. Hope,\* amounting to a considerable number, upwards of two-thirds were referable to this source. Similar is the evidence furnished by the dissections of Dr. Townsend, Andral, Bouillaud, Bertin, and other anatomists. Indeed, apoplexy of the lungs may be said to have the same connection, precisely, with hypertrophy of the right side of the heart, that apoplexy of the brain has with that of the left,—the tendency, in both cases, being to throw the blood with more impetuosity and force upon the respective organs. Should there be a contraction of the mitral valve, the blood will stagnate in the left auricle, and the pulmonary vessels be constantly engorged from the obstacle in the venous circulation. When this state is conjoined with thickening of the walls of the right ventricle, nothing, it may be presumed, would be more easy than the supervention of hemorrhage, whether as a simple exhalation, or as the result of a laceration of one or more vascular branches. The deposit of blood in the pulmonary tissue is also a frequent attendant upon phthisis; and, in some instances, it is found to be *accidental*, the fluid being poured down the wind-pipe from an ulcerated artery of the tongue, palate, or fauces, or from the bursting of an aneurismal sac.

The pathognomonic signs of pulmonary apoplexy are, dulness of sound on percussion, and extinction of the respiratory murmur in the part which corresponds with the seat of the disease, together with a crepitating rhonchus in the immediate neighborhood. When these phenomena—the rationale of which will readily occur to the reader—are conjoined with hæmoptysis, no doubt can be entertained of the true nature of the disease.

*Encephaloid* seldom occurs in the lungs. This affection, which constitutes the cancerous phthisis of Bayle, and the medullary tumor of Laennec, may exist under several varieties of form. Thus, it may be diffused through the inter-vesicular tissue, in small, uncircumscribed patches; or it may be deposited in irregular spherical masses, varying in size from a small pea to that of a full-grown foetal head; or, lastly, it may present itself in the character of an encysted tumor, which, in fact, is most usually the case. In this variety, the heterologous growth rarely exceeds a common-sized apple, and the capsule surrounding it, although hard and tough, is scarcely half a line thick, and of a white greyish color: the adhesion between the two structures is usually very slight, and the vessels which are so abundantly distributed upon the latter, can seldom be traced to any great depth into the former. In some cases, the medullary matter occupies only a single cyst; in others, there are as many as six or eight, united together into one lobulated mass. Laennec, who has given a very good account of this disease, describes it as passing through three different stages. In the first, the encephaloid matter is of the consistence of concrete lard, lobulated, and of a pale yellowish color; in the second, it has an appearance very much like that of the human brain; and, in the third, it is soft, moist and pulpy. Clots of blood, of a deep red, brown, or blackish color, are frequently intermixed with this substance, altering its appearance and consistence.

Of this disease I have never observed an example in this organ, and feel disposed to think it uncommon in the United States. Dr. Morton† has seen

\* *Morbid Anatomy*, p. 41.

† *Illustrations of Pulmonary Consumption*, p. 85. Philadelphia, 1834.

only a single case of it in a great number of dissections; and Bayle\* witnessed it only thrice in nine hundred subjects.

No diagnostic signs of this disease have yet been pointed out. If the tumors are numerous, or of considerable magnitude, there will probably be dulness on percussion, with diminution or absence of the vesicular murmur, pain in the chest, dyspnœa, and that peculiar state of the complexion which so often attends this lesion in other organs.

The lungs are liable to *melanosis*, though this may be classed amongst the rarest affections met with in these organs. It is commonly seen in amorphous masses, in small nodules, in thin, irregular laminæ, or in minute dots. The tuberiform variety, which is perhaps the most common, occurs in globular, oval, or pyriform tumors, from the size of a currant to that of an egg, or even a large apple. Sometimes they are encysted, the capsule by which they are enclosed being composed of dense, cellular tissue, about half a line thick. Their surface is either smooth, unequal, lobulated, or studded with small tubercles, like a mulberry; and their consistence varies between that of tallow and that of a lymphatic gland, though occasionally they are quite fluid. The circumjacent textures are generally sound, and the connection between them and the heterologous bodies is often so slight as to require but little dissection to separate them from each other.

Melanosis of the lungs must, on the whole, be regarded as a very rare disease in the inhabitants of this country. Of the tuberiform variety, I have seen only two or three examples; nor have I been more successful as respects the others. The deposition, which is most frequent in old people, especially in such as are of a strumous diathesis, seems to be merely an excess of secretion of the black pigment, which is sometimes so conspicuous in the organs at that period of life. Andral† relates the case of a man, fifty-nine years of age, in whom the left lung was entirely converted into a black, homogeneous substance, of such density that the scalpel could scarcely penetrate it: the whole appeared like a mass of extravasated, black injection, after it has cooled.

There is a variety of black substance, which, instead of being a product of secretion, like that just described, is introduced with the air in breathing, and carried by the absorbent vessels into the intervesicular tissues. It is most common in colliers, moulders, and other persons who are habitually exposed to the inhalation of carbonaceous matter. Old age is the period of life most liable to it, though it has been noticed in comparatively young subjects. The foreign substance may be solid, semi-liquid, or fluid, and may occur as an infiltration, or in the form of granules, or, finally, in lines, or streaks, having a retiform or pentagonal arrangement. Both lungs are generally affected at the same time and in an equal degree; they are of a uniform black, or bluish-black color, indurated, friable, and infiltrated with black serosity. Sometimes, especially when the deposit coexists with tubercular disease, they contain excavations, the parietes of which are bedewed with the foreign matter, and which is then often expectorated, for weeks and months together, in considerable quantity. The bronchial lymphatic ganglions almost always partake of the black discoloration.

This matter is without taste or smell, insoluble in muriatic and nitric acid, miscible with water, and of a black color, like charcoal, soot, bistre, or China-ink. It is not bleached by chlorine, nor is it affected by putrefaction. When dried, it burns like charcoal, with scarcely any animal empyreuma, and leaves a considerable quantity of pale-grey ash. Mr. Graham,‡ of Glasgow, who has carefully investigated this substance, has shown that it is of an inorganic

\* On Phthisis.

† Archives Générales, for April, 1829.

‡ Edin. Med. and Surg. Journ., vol. 42, p. 323.

carbonaceous character, and that it bears the closest resemblance to lamp-black. Destructive analysis yielded carburetted hydrogen, and the other usual products.

*Serous cysts*, containing a thin, limpid fluid, are occasionally found in the lungs. They are often seen in the inferior animals, as the ox, sheep, and goat, but are of very rare occurrence in the human subject. Morgagni gives only a single instance of these accidental growths; and Laennec seems never to have met with them. I have never seen them in this situation.

Equally rare are the *hydatids* which are sometimes seen in the human lungs. Of a globular, ovoidal, or pyriform shape, they are of variable magnitude, of a firm, semi-concrete consistence, and usually, if not always, of the acephalocystic kind. Their coats are of a light greyish color, sometimes speckled with opaque, yellowish dots; and their contents, which are generally of a thin, limpid nature, like spring-water, are often milky, brownish, or sero-sanguinolent. The internal surface of the hydatid is frequently rough, and lined by a thin layer of lymph. Seldom is the number of these bodies great, or their size large. Occasionally, however, there is a very large one, including several of smaller dimensions. Dr. Geoffroy, a French writer, has furnished the particulars of the case of a young man, aged twenty-two, in whose lungs were two enormous hydatids, each eleven inches long, which adhered to the ribs and mediastinum, and reduced these organs each into a thin, spongy cake, lying in the anterior part of the thoracic cavity. Each contained about five pints of thin, watery fluid; and they were supposed to have originated in the pulmonary tissue.\*

These bodies, like the serous cysts before adverted to are extremely infrequent in the human lungs. Out of nearly six thousand patients, says Andral,† admitted into the wards of M. Lermnier, in six years, pulmonary hydatids were seen only five times. In one of these cases, they occurred in the pulmonary veins; but, in all the others, they were developed in the midst of the parenchymatous structure.

Neither hydatids nor cysts seem to give rise to, any pathognomonic symptoms. Oftentimes they acquire a considerable magnitude without creating any pain, local suffering, or dyspnoea. It is only when they compress the delicate substance of the lungs by their great size, that they interfere with its functions. Sometimes they are ejected by coughing; and, in such cases, it is conceivable that the patient may get well.

Of *calcareous, earthy, or cretaceous concretions*, as occurring in the lungs, mention is made by almost every writer, on morbid anatomy, since the time of Bonetus. These bodies, of which I have seen many examples, are usually observed in small rounded nodules, of a greyish white color, friable, semi-concrete, sometimes hard, consisting almost entirely of phosphate and carbonate of lime, with a minute proportion of animal matter.‡ Cases occur in

\* Bulletin de l'Ecole de Med. au 1805. (See Laennec, p. 381.)

† Clinique Medicale; translated by Spillman, p. 553.

‡ Very recently these concretions were analyzed by Professor Squarzi, of Bologna, who found the following ingredients:\*

Phosphate of lime	-	-	-	-	-	-	-	-	1.56
Carbonate of lime	-	-	-	-	-	-	-	-	0.39
Carbonate of magnesia	-	-	-	-	-	-	-	-	0.06
A peculiar fatty matter	-	-	-	-	-	-	-	-	0.06
Cholesterine	-	-	-	-	-	-	-	-	0.66
Mucus	-	-	-	-	-	-	-	-	0.09
A yellow brown substance	-	-	-	-	-	-	-	-	0.03
Oxide of iron	-	-	-	-	-	-	-	-	0.09
Silex	-	-	-	-	-	-	-	-	0.03
Loss	-	-	-	-	-	-	-	-	0.03

3.00



which these concretions are of a dark color, oval, cylindrical, or pyriform, hard and gritty, or rough on the surface, like a mulberry calculus of the urinary bladder.

Their dimensions are very variable. From the size of a mustard-seed they may attain, and even exceed, that of a peach-stone; though, in the generality of cases, they do not surpass the volume of a currant, a pea, or a small cherry. Their number is in an inverse ratio to their size. In the French Dictionary of Medical Sciences is recorded the case of a phthisical person, who, during eighteen months immediately preceding his dissolution, expectorated upwards of two hundred small stones; and in another, mentioned by Portal, between five and six hundred were coughed up.

These concretions are sometimes perfectly white like chalk, and of the consistence of putty, or fresh mortar. They are generally invested by a cyst, which is of a pale bluish or greyish color, fibrous, or fibro-cartilaginous in its structure, and from the sixth of a line to a line and a half in thickness. There can be no doubt, from the recent investigations of Rogée and Valleix, that these concretions, no matter what may be their color and consistence, are merely degenerated pulmonary tubercles. In proof of this it may be stated that the cretaceous deposit, as it is called, is often seen at one point, the calcareous at another, and the tubercular at a third, the conversion constantly begins at the centre of the morbid mass, in the form of pultaceous, chalky, or putty-like matter, which in time completely subverts the original structure, and is itself ultimately replaced by calcareous substance, the last alteration of which these formations are susceptible. Advanced age favors this degeneration; which, however, is sometimes observed in young subjects, and even in children. Of one hundred old persons examined by Rogée, not less than fifty-one had calcareous concretions.

I am not certain that these bodies can give rise, by their presence in the lungs, to any serious inconvenience. Bayle thought they might; but his opinion has been successfully controverted by Laennec; and, from having myself several times found them in persons who, during their life-time, had no embarrassment of breathing, I am disposed to agree with this writer, in the belief that they are commonly harmless.

The lungs are liable to *hypertrophy*. It is a law of the animal economy, that in proportion as a part is exercised, so will be its size and strength. This is strikingly exemplified in the muscular system, and also in some of the other organs, as the lungs, testicles, kidneys, and mammæ. Under such circumstances, the organ increases in bulk, its texture becomes more firm and elastic, and the air-cells, although this cannot be demonstrated, are probably enlarged, at the same time that their walls are thickened and strengthened. The augmentation of volume is sometimes extraordinary. More than once have I seen the hypertrophous lung permanently dilate the chest, force down the diaphragm, displace the heart and mediastinum, and project up nearly two inches into the neck between the clavicle and spinal column. In this way, although one lung may be entirely gone, the individual may live for years in tolerable comfort. Such seems to have been the case with the lamented Godman, one of the brightest ornaments of our profession. With one lung he was obliged to toil for his daily substance, for nearly two years, undergoing a degree of labor which has scarcely ever been equalled by any literary or scientific man, in the most perfect health.

*Atrophy* of the lungs, the reverse of the condition just described, is generally produced by accidental circumstances. In great emaciation of the body, such, for example, as is witnessed in protracted fevers, or painful local disor-

ders, the lungs do not seem to participate in the decay, at all events, not to any appreciable extent. That these organs experience some changes in cases of wilful abstinence, when all the other viscera are in a normal state, has been already seen;\* but what these changes are, whether they consist in some structural lesion, or in some derangement simply of the nutritive function, has not been determined. In old age, the pulmonary tissue becomes sensibly altered; it no longer possesses the same softness, the same pliancy, or the same color, that it did in youth or adolescence; on the contrary, it is dry, imperfectly elastic, of a pale greyish tint, and comparatively ill supplied with blood. Its absolute bulk and weight are diminished, and the parietes of the air-cells are attenuated and enfeebled.

But these are not the only causes of pulmonary atrophy. In most cases, as was before intimated, it is dependent more immediately upon causes exerting a local influence, and hence it is usually found in association with effusions of water, lymph, pus, or air into the thoracic cavity, or with tumors pressing upon the large bronchial tubes. In such cases, I have repeatedly found the lung reduced to a mere cake, scarcely more than an inch in thickness, by several inches in diameter, with a dark, dense, inelastic structure, almost void of air-cells. This accidental atrophy, which may occur at any period of life, in infants, in children, and in adults, is usually connected, provided the patient survives sufficiently long, with hypertrophy of the opposite lung.

*Pulmonary phthisis.* — By far the most interesting disease of the lungs is phthisis, whether we consider the frequency of its occurrence, the rapidity of its progress,† its almost uniform fatality, or the obscurity which still envelopes its ætiology.‡ This affection essentially consists in a slow disorganization of the pulmonary tissue, occasioned by the development of tubercles. Such at least is the sense in which the term is received by every intelligent writer of the present day of whose works I have any knowledge. Nor is this notion peculiar to the physicians of the nineteenth century. P. Dessault, of Bourdeaux, in an able essay on phthisis, published more than a hundred years ago, clearly states that tubercles constitute the essence of consumption; and the same doctrine is warmly inculcated in the immortal work of Laennec. Similar views have been promulgated, within the last fifteen years, by Louis, Andral, and other pathologists, both on the continent of Europe, in Great Britain, and in the United States.

The opinion now generally prevails, that the *primary seat* of tubercular matter is in the air-cells and minute bronchial tubes. For our knowledge of this interesting and important fact, we are mainly indebted to MM. Schræder Van der Kolk, Cruveilhier, Magendie, and Carswell, whose researches in this and other departments of pathological science are worthy of all praise. These distinguished anatomists have fully decided the question — which many have hitherto disputed — that the morbid product in question is, in the majority of cases, secreted by the mucous tissue of the lungs, instead of being poured out into the interstitial cellular substance, as was maintained, until lately, by the French school. That this doctrine concerning the site of tubercular deposits is true, as a general rule, observation has fully convinced

\* See article *Gangrene*.

† This remark has reference, of course, only to the heterologous formations.

‡ "It has been calculated, by the late Dr. Young, Dr. Woolcombe, and others, from the best data which the bills of mortality afford, that, in Great Britain and Ireland, consumption causes one-fourth part of the deaths that occur from disease." (Clark's Treatise, p. 8.) In this country, the mortality from this source, I doubt not, is equally great; though upon this point I cannot speak positively, having no accurate data from which to deduce my conclusion.

me. Nevertheless, I am far from believing that it is applicable to all cases; for an instance occasionally occurs, where the matter is evidently, in a great measure, if not wholly, confined to the cellular texture. These cases, I acknowledge, are rare, yet that they really exist, is indisputable. Independently of their easy demonstrability, in this situation, analogy is strongly in favor of the position here contended for. In the kidneys, for example, how often does it not happen, that the heterologous bodies are seated exclusively in the so called cortical tissue, notwithstanding the amount of mucous structure within? They are also frequently seen in the bones, in the substance of adventitious membranes, in the interior of the spleen, and on the surface of the serous membranes,—parts which are perfectly devoid of the tissue under consideration. The presence of this tissue is therefore not at all necessary to the production of tubercles, nor is there any reason for concluding that these deposits should be invariably formed by it, even where it abounds in an organ as it does in the lung.

The *varieties of form* in which this matter is deposited were pointed out in a previous section. Referring the reader to the general history of tubercle, I shall limit myself here to the statement of a few leading facts, which will enable him, it is hoped, more fully to comprehend the character of the lesion before us.

Of the four varieties of tubercular deposits already described, the *miliary* is unquestionably by far the most common. It occurs in at least forty-nine out of every fifty cases of phthisis. The individual granules, in this form of the complaint, vary in volume between a mustard-seed and a filbert: they are generally of a pale yellowish color, and of a semi-concrete, friable consistence, like dry curds. A greyish hue is not uncommon: occasionally they have a greenish, vitreous aspect, and a degree of firmness amounting to fibro-cartilage. This is especially the case in that variety of these little bodies to which Bayle has applied the appellation of *grey granulations*, and which this celebrated author considered, though erroneously, to be distinct from genuine tubercles. Studied in the early stage of their development, the granules, of whatever appearance they may be, are always soft and isolated; by and by, however, they augment in consistence, and run into each other, forming, thus, large nodules, of variable color, size, and shape. Not unfrequently, the little masses are seen hanging from branch-like pedicles, a disposition strongly resembling that of the cauliflower. Sometimes they contain particles of foreign matter, such as grains of sand, especially in miners, masons, and grinders; and cases occur in which their central portions remain empty, producing an arrangement, when divided, of internal depressions. At other times, there is a distinct nucleus of inspissated mucus, around which the tubercular matter is deposited, and which gives rise, as is supposed by Carswell, to the appearance of central softening, so much insisted on by Laennec.

The number of miliary tubercles is extremely variable. In some instances, though this is rare, there are only a few, nay, perhaps, only a solitary one; but, in the vast majority of cases, there are hundreds and thousands, of all sizes, from that of a pinhead to that of a hazelnut. All parts of the lungs are liable to be affected by them; but, as will be shown hereafter, the superior lobes are their most frequent seat. Occasionally, they are confined to the interior of the organs, the external surface being entirely free from them. This, however, is rare.

These little masses sometimes appear *encysted*; but this arrangement, I am strongly disposed to believe, is in most instances altogether deceptive, as it probably depends entirely upon the manner in which the tubercular matter is



impacted in the bronchial tubes. Such, at any rate, I have found to be the case in my own dissections; for, except on two or three occasions, I have never been able to detect any thing like a cyst of new formation, similar to what has been described by some of the French and German anatomists.

The *stratiform variety* is also very rare in the lungs; and so likewise is the infiltrated. The former I have observed only in a single instance, and then not in the human subject: the latter I have noticed several times, but never to any considerable extent. The matter, in this form of the disease, may be diffused through several contiguous lobules, an entire lobe, or even the whole lung; and, as in the miliary variety, it generally occupies the air-cells, and the minute bronchial tubes, the parietes of which are at the same time somewhat thickened, and preternaturally brittle. Although usually of a yellowish color, it often varies from a light grey to a dark slate, arising from the intermixture of black pulmonary matter, which occasionally imparts to it a variegated, marbled tint. Its texture is homogeneous, opaque, and of a firm, semi-cartilaginous consistence: when torn, it exhibits a rough, granular surface, and seems to be entirely composed of small, irregular bodies, which, from the peculiarity of their arrangement, have been compared, not unaptly, to the eggs of certain insects, placed in close contact with each other. The tubercular infiltration is originally deposited in detached, lozenge-shaped patches, which, in time, coalesce, and so involve a considerable portion of pulmonary tissue: it is most common around old caverns, and is occasionally seen in conjunction with some of the preceding varieties, especially the miliary.

The *pulmonary tissue* around these deposits is variously altered. In the early stages of the disease, before the secretion has made much progress, it is not unusual to find the surrounding parts quite sound. This state, however, rarely continues very long; for, after the tubercles have existed for some time, they invariably act as extraneous bodies, the more so if they are very large or numerous, producing different morbid changes, such as congestion, inflammation, softening, induration, serous infiltration, and the formation of accidental tissues, of a cellular, fibrous or cartilaginous nature.

Of these pathological conditions, none is more common than congestion. Nor is this surprising, when we remember the compressed and obstructed state of the pulmonary veins. The blood, being thus prevented from finding a ready outlet, must necessarily accumulate in the capillary vessels around the morbid deposits, which, in consequence, often exhibit quite a red appearance, the vessels being arranged in beautiful arborescent lines, some of which are occasionally traceable into their substance. As the result of this engorged condition, the pulmonary tissue is frequently infiltrated with serous fluid, the quantity of which is sometimes so great as to lead to great embarrassment of breathing, from the want of the free admission of air into the lungs. Hæmoptysis is also not uncommon. Pure uncomplicated congestion occurs much oftener, according to my own observation, in children and young persons than in the old, or in such as are greatly exhausted by the disease. If it be allowed to go on unrestrained, it produces, sooner or later, an effusion of lymph, with consequent hardening and atrophy of the pulmonary texture. Softening, gangrene, and ulceration, are also occasionally noticed, but much less frequently, I apprehend, than some have imagined.

The air-cells and minute bronchial tubes, the primary seats of the morbid deposit, are usually more seriously affected than the rest of the anatomical elements of the lungs. Not only are they obliged to bear the brunt of the disease, but, as might be anticipated, they must generally labor under considerable irritation for some time, even before the matter is poured out. Nor is it

reasonable to presume that the irritation thus set up will wholly subside during the progress of the secretion. As the matter accumulates in these reservoirs, it presses upon them on all sides, by which, whilst their caliber is enlarged, their parietes are generally attenuated, and finally destroyed, by ulcerative absorption. Hence, when caverns form, the bronchial tubes generally open into them abruptly, as if they had been cut across with a sharp instrument. Along with these changes, there is very commonly a red and injected state of the lining membrane, which sometimes extends up into the trachea, and even into the larynx.

After having existed for some time, varying, on an average, from one to nine months, the tubercular matter, whatever may be the form in which it is deposited, manifests a disposition to become soft. The process by which this is effected was pointed out in a previous section, to which the reader is referred for an account of it. On the present occasion, I shall content myself with a description of the changes which are induced by it in the pulmonary tissue.

Of these changes, the most important is the formation of *excavations*, *caverns*, or *fistulous apertures*. These were formerly considered, under the name of *vomicæ*, to be essential to the existence of phthisis. It is now well known, however, that it may prove fatal without them, especially that variety of it which is vulgarly denominated "galloping consumption," and which is marked by great febrile disturbance. In their size, these cavities are very variable; but, as a general rule, it may be said to be in direct ratio to their number. When there is only one, it is occasionally as large as the fist, and capable of holding half a pint or more of fluid: on the other hand, when they are numerous, they rarely exceed a walnut, and frequently they are not larger than a hazlenut, an almond, or a pigeon's egg. In their shape, they are for the most part irregularly rounded, sometimes ovoidal, and occasionally angular. In respect to their number, not less than in regard to their size and shape, much diversity obtains. It is seldom that there are more than two or three, yet, in some instances, the number is truly surprising. Not long ago, I examined the body of an old man, sixty-two years of age, whose right lung was literally one continuous chain of excavations, the largest of which was scarcely as big as a billiard-ball. Upwards of forty were counted. Many communicated together by short, fistulous tracks, and nearly one-half of them were completely empty.

The largest excavations are almost always found in the superior lobes, inasmuch as the softening process usually proceeds there to a much greater extent than elsewhere. It also, for the most part, commences at this situation. Hence nothing is more common, in making examinations, than to meet with caverns in the summits of the lungs, with half-softened tubercles further down, and with crude tubercles and sound pulmonary substance at the base of these organs. In the majority of cases, the cavities occur in both lungs. In children the caverns are generally much smaller, as well as much less numerous, than in adults, and they rarely exist simultaneously in both organs. Mr. Green, of London, states that they are commonly seated in the middle or lower lobes, an assertion verified by my own dissections.

When recent, the *walls* of the excavations are soft, and lined by a thin layer of lymph, which is easily separated from the surrounding parts: in more protracted instances, the false membrane is dense, greyish, sometimes fibro-cartilaginous, and from one fourth to one third of a line thick. Occasionally several lamellæ are thus deposited, the one last formed being always more delicate, more easily torn, and of a more yellow color. In some instances, the excavation is entirely destitute of a lining membrane, the parietes being formed

by indurated pulmonary tissue, having a raw, fleshy appearance, not unlike the surface of a granulating ulcer.

The contents of these cavities vary, according to the period they have existed. Such as are recent, generally contain thick, cream-colored, inodorous matter, like common pus ; whilst, in such as are of long-standing, the fluid is of a thin, bloody, sanious character, and often quite offensive. Cretaceous matter also is sometimes found in them, and occasionally a substance resembling fibro-cartilage. It is only in recent cases, and then very seldom, that the excavations contain fragments of pulmonary tissue. The period required for emptying themselves varies from a few weeks to several months, according to the size of the tubercular mass, the extent of the local disease, and the state of the system.

It is very seldom that we find the older caverns perfectly smooth internally : their surface is almost always ragged and uneven, and the irregularity is apt to be still further increased by their being intersected in different directions by small cord-like bodies, consisting either of condensed cellular substance, or of impervious vessels. (See Fig. 125.) In their shape, these little bundles bear a very close resemblance to the fleshy columns of the heart ; their length is variable ; in thickness, they are from one to two lines : they are thinner at the middle than at the extremities ; and they are usually incrustated with yellowish tubercular matter. It is a singular circumstance, and one which has been noticed by every intelligent observer, that these excavations seldom, if ever, contain any remains of the bronchial tubes. The pressure that is exerted upon these structures by the tubercular matter, both internally and externally, would seem to be sufficient to produce their speedy absorption ; and hence it is extremely rare to find the slightest relic of them, even where the cavern is only partially evacuated, or the heterologous deposit only slightly softened. Nor does the cavity always communicate with the air-passages. In some instances — and these are not infrequent — it is completely closed, so that its contents, being unable to work their way out, either remain, or are finally absorbed. More commonly, however, one or more bronchial tubes open directly into it, and serve to carry off whatever may be lodged within. Occasionally the matter escapes into the pleuritic sac, where, in a short time, it excites fatal inflammation. Dr. Morton, of Philadelphia, describes an interesting case, where the cavern, which was encysted, and situated in the apex of the right lung, communicated, by a fistulous opening, with a large abscess in the back.

It has already been stated that tubercular caverns are often intersected by small *vascular cords*, the vestiges, evidently, of the arterial and venous branches that supplied the affected structure. The changes which these ves-

Fig. 125.





sels undergo, in such cases, are exceedingly interesting. Long before the softening begins, their caliber is obliterated, as if nature, intent on preventing hemorrhage, took care to anticipate the ulcerative process. In the early stage of the disease, the vessels are merely forced aside, and compressed by the tubercular matter; but as the deposition advances, they gradually become impervious, and are at length converted into hard, fibrous cords, like the umbilical vessels of the infant after parturition. Thus affected, they are greatly diminished in volume, and no longer admit the finest injecting matter: even air cannot be made to pass along them: in a word, they are completely, effectually, permanently obliterated.

But for the above provision, which is as admirable as it is beneficent, few individuals would survive the softening process. As it is, with all the care that nature can exert, fatal hemorrhage is unfortunately of too frequent occurrence, arising from the rupture of the affected vessel, in consequence of the inability of its walls to withstand the shock of the circulating fluid. The blood occasionally finds its way from the cavern by a fistulous opening into the œsophagus. Of this an interesting case is related by the late Dr. Mackintosh,\* of Edinburgh, in his excellent treatise on the Practice of Medicine. The patient was a child, which had labored for some time under cough and anomalous symptoms, and died suddenly from what was supposed to be hæmatemesis. On inspection, it was discovered that the blood contained in the stomach and bowels, had proceeded from a ruptured artery in an excavation in the upper lobe of the left lung. From this a fistulous passage was seen running high up into the œsophagus, along which the fluid had flowed into the stomach.

Owing to the crippled and embarrassed condition of the branches of the pulmonary artery, above alluded to, nature is not slow in establishing a supplementary circulation, to compensate for the defects of the old. The new vessels appear as red lines, which taper off at each end, and are scarcely a millimeter in diameter; their parietes are extremely delicate, and they are at first perfectly isolated, but in time they assume a retiform arrangement, and communicate not only with each other but likewise with the bronchial arteries, or with those of the walls of the thorax. The latter connexion is effected, as has been shown by Van der Kolk, by means of new vessels developed in the false membranes of the pleura. The amount of vascularization established in this manner increases in proportion to the amount of the tubercular deposit; it pervades the whole of the affected lung, and serves as a substitute for the obliterated branches of the pulmonary artery. How far these new vessels, which have been minutely described by Van der Kolk, C. Baron, Valleix, and Guillot, and which may frequently be rendered remarkably distinct by artificial injection, contribute to the vitality of the heteroclitic deposit, is unknown. Louis maintains that they are specially created for its nutrition, and the promotion of its growth; an opinion which, to say the least of it, is highly plausible. This, however, if it be one of the uses of this supplementary circulation, is not the only one. Another, and perhaps still more important office, is the influence which it exerts upon the oxygenation of the blood, which is distributed to it by the aorta through the bronchial arteries, and which is returned to the heart by the bronchial, pulmonary, and azygos veins. "This condition of the circulation," as has been observed by a distinguished writer,† "is one that manifestly cannot subsist without materially altering the blood of phthisical subjects, and thereby affecting their organization generally. The main result

\* Vol. i., p. 241, Philadelphia Edition.

† Dr. Bell, Lectures on the Theory and Practice of Medicine, vol. ii., p. 240, third edition, Philadelphia, 1845.

in respect of function may be expressed thus — that in proportion as tuberculization advances, the lungs acquire increasing capacity for arterial, and lose it for venous blood.”

One of the most interesting facts, in relation to these caverns, is, that they are susceptible of *cicatrization*. That this occurrence is rare, common sense alone, unaided by observation, is sufficient to convince us ; but that it occasionally takes place is abundantly proved by the researches of Laennec, Andral, Forbes, Carswell, Morton, and other pathological anatomists. Indeed, every physician who is at all in the habit of making dissections, must have met with examples of this kind. I have had occasion to observe it in a considerable number of cases, and have taken care to preserve specimens of it in my cabinet.

There are three modes in which the healing may take place, each of which is deserving of brief notice. In one of these, which is by far the most common, the cavern remains open, and its surface becomes lined with a thin layer of plastic lymph : this adheres more or less strongly to the surrounding textures, is gradually organized, and finally converted into a membrane, which possesses all the properties of the mucous tissue, excepting that it is devoid of inucous glands, and therefore incapable of secreting genuine mucous matter. Secondly, the cicatrization may be effected by the contraction of the excavation, and the slow but steady agglutination of its sides, through the intervention of dense cellular substance of new formation. Thirdly, it may take place by an effusion of coagulating lymph, or repeated depositions on the inner surface of the cavity, forming a white bluish mass, more or less dense in its structure, in which the bronchial tubes may be seen abruptly terminating. In the two last varieties of cicatrization, the contraction of the accidental tissue gives rise to a puckering of the lung, which is most distinctly marked when the serous envelope of the organ is forced to follow the retrocession of the parenchymatous substance. These scars — for thus they may be called — are most common in the apex of the lung ; and they may assume various figures, — oval, circular, linear, arborescent, or stellated.

Appearances similar to these may be produced by the deposition of fibrin upon the pulmonary pleura. In acute inflammation of the serous membrane of the chest, there is generally an effusion not only of this substance but also of serosity, either simultaneously or successively. Should the serosity be poured out first, it will have the effect of compressing the lung, and of preventing adhesion between the pulmonary and costal pleura. As the effused matter is absorbed, the organ gradually expands, and ultimately regains its original form, volume, and situation. If, however, while the lung is in this position, a layer of fibrin be deposited upon its surface, it will be liable to be permanently compressed, and at length, owing to the contraction of the new substance, exhibit the depressed, corrugated, puckered, or mammillated appearance, so often mistaken for the cicatrice of a tubercular excavation, and as an evidence of the cure of pulmonary phthisis.

Although tubercles generally coexist in both lungs, yet the left of these organs is commonly more extensively involved than the right. This circumstance, which was long ago noticed by Bonetus, Morgagni, and Stark, is fully confirmed by the recent observations of Louis, though it is opposed by the high authority of Laennec and Lombard, as well as by that of Dr. Mackintosh\* and Dr. Home, of Edinburgh.† It is also in accordance with the experience of

\* Principles of Pathology and Practice of Physic. Morton's edition, vol. i., p. 436.

† This gentleman, in an able report on phthisis, published in the January number of the Edinburgh Medical and Surgical Journal for the present year, states that out of one hundred cases, he

Dr. Morton, of Philadelphia. In eighty-six cases analyzed by this distinguished physician, both lungs were equally affected in seven, the left most in fifty-one, and the right in twenty-eight. In two hundred and fifty cases mentioned by Dr. H. M. Hughes, in Guy's Hospital Reports, for April, 1842, the left lung was chiefly affected in one hundred and sixteen, and the right in eighty-nine, the more diseased side being doubtful in the remaining forty-five.\* These conclusions are fully sustained by the results of my own dissections. With the exception of twelve or fifteen cases, I have invariably found the left organ more extensively implicated than the right. In a few instances, the heteroclitic deposit was confined to one side. Upon what the difference here referred to depends, is a point which has not been satisfactorily explained.

Not less strange is the fact that the morbid deposit is almost constantly more copious and perfect at the summit, than at the base of the lungs. So true is this, that it may be laid down as a rule, scarcely liable to a single exception. Various explanations have been offered with a view of accounting for this phenomenon; but, so far as I know, they all rest upon conjecture, and therefore scarcely deserve mention. That the confined and compressed state of the superior lobes of the respiratory organs should exert an injurious influence, predisposing these parts to disease, can scarcely be doubted; but that it is the only cause of the proneness in question, I am by no means inclined to believe. Granting that the circumstances adverted to do produce a mischievous tendency, if nothing more, it seems to me that the real cause consists in a diminished supply of blood, and in a consequent debility of the parts under notice. Owing to our erect position, the circulation here is carried on with difficulty; the pulmonary tissue is imperfectly nourished; the proper stimulus resulting from the due admission of the sanguineous fluid is withheld; and hence, wherever any cause exists that has a tendency to produce tubercular disease, it generally exerts its baneful effects upon this particular portion of the organ, in preference to others that are more directly under the control of the sanguiferous and nervous systems. This conjecture — for we claim for it no other appellation — receives support from the fact, now well established, that, in quadrupeds, the dorsal portion of the lung, which in reference to the effect of gravitation may be said to correspond to the apex of the human lung, is generally more extensively tubercularized than the rest of the viscus.

Louis has ascertained, from a careful examination of 358 cases, of which 127 died of phthisis, that tubercles rarely, if ever, occur in any organ in the body after the fifteenth year, unless they also exist in the lungs. These results have been verified by other observers, and may therefore be regarded as constituting an important law. It has been further ascertained, chiefly through the researches of Rilliet and Barthez, that tubercles are more diffused, and of more frequent occurrence in other viscera, without affecting the pulmonary tissues, in infancy than in adult age.

*Sex* appears to exercise a considerable influence on the production of phthisis. According to Louis, women are more prone to it than men, in the proportion nearly of nine to seven. This conclusion of the French author is fully con-

found both lungs equally affected in twenty-five, the right most in thirty-eight, and the left in thirty-seven. In five cases in which one of these organs only was diseased, four were on the right, and only one on the left.

\* Of the two hundred and fifty cases, reported by Dr. Hughes in the work before referred to, the upper lobe of one or both lungs was solely or principally diseased in two hundred and thirty-seven. Of the thirteen remaining cases, of which eleven occurred in males, and only two in females, there were nine, or three and three-fifths per cent. of the entire number, in which both lungs were universally and uniformly affected.



firmed by the more recent researches of several of his countrymen. M. Chateauneuf, in a very interesting memoir, states that, out of 1544 deaths from pulmonary consumption, 745 were men, 807 women. In the statistical tables of Paris, published under the auspices of M. Charbol, in 1830, we find that, out of 9542 cases of this disease, 5582 were females, 3960 males. Upon this subject my own experience is too limited to enable me to speak positively ; yet, so far as it goes, it is decidedly in favor of the greater predominance of this disease in men than in women : certain am I that I have examined the bodies of five of the former to one of the latter. It is altogether probable that the mortality from this cause varies in the two sexes in different regions. This, indeed, is rendered almost certain by the calculations of Dr. Clark, published in his excellent treatise on consumption.\* Thus, for example, in New York, the proportion of males to females, in round numbers, is as ten to eight ; in Berlin, as ten to eleven ; and, at Edinburgh, as ten to six.† In Sweden, the proportion is nearly equal. In Prussia, if Berlin can be taken as an illustration, phthisis in childhood appears to be much more common among females than among males.

The period of life most liable to phthisis is between twenty and forty. This fact, which was pointed out by Hippocrates, has been amply confirmed by the united experience of modern physicians. Of one hundred and twenty-three patients observed by Louis, not less than seventy-two died during this interval. These results are confirmed by those of Bayle, Darwell, Home, Morton, and other writers. In two hundred and eighty-one phthisical persons, who died in the Philadelphia almshouse in three years and a half, ending with the month of June, 1833, one hundred and ninety-three perished under forty years of age. Forty-two died between the ages of forty and fifty ; twenty between fifty and sixty ; twelve between sixty and seventy ; three between seventy and eighty ; two between eighty and ninety ; one between ninety and a hundred.‡ From the recent report of Dr. Home, showing the ages of ninety-six persons treated in the Royal Infirmary of Edinburgh, it appears that sixty-six, or upwards of two-thirds, died between twenty and forty. The mortality below twenty was eleven ; that above fifty, eight.§ From a careful analysis of the statistical reports of the principal cities of Europe, and the United States, Dr. Clark has deduced similar conclusions. The remarkable agreement of all the places, says this distinguished author, warrants the statement, that fully one half of the deaths from consumption occur during the period above specified, and that the mortality is at about its height at thirty, and from that time gradually diminishes.

Dr. Lombard, of Geneva, has found that children are most prone to tubercles between the ages of three and six, inclusive. We have no correct data for estimating the frequency of phthisis immediately under and above this period, but the number of deaths is considerable. Infants are sometimes born with this disease. Of this occurrence, several well-authenticated cases are now on record ; that they are uncommon, however, cannot be doubted ; and, thus far, it has not fallen to my lot to meet with them. As was stated in a previous part of this work, I have in several instances observed tubercles in very young children ; and similar observations have been made by some of my friends. Andral supposes that phthisis is most frequent among females below the age of twenty ; but this opinion, although supported by his own experience,

\* London edition, p. 183.

† See Dr. Home's Report, *Edinburgh Med. and Surg. Journal*, No. 134.

‡ Morton's *Illustrations of Pulmonary Consumption*, p. 48, First edition.

§ *Edinburgh Med. and Surg. Journal*, p. 3, No. 134.

and by the statistical tables of Berlin,\* requires further proof before it can be received as true.

The *duration* of phthisis varies from a few weeks to several years, the average being about nine months. This estimate is founded on the data furnished by Bayle and Louis, which, in the main, agree with the calculations of Dr. Home and Dr. Clark. The duration is greatly influenced by the previous state of health, by the accompanying lesions, by the mode of life, and, above all, by the season of the year. In Edinburgh, most of the deaths from consumption occur in the summer; whilst, in London, according to Dr. Heberden, and others, they are most frequent in the winter. In Glasgow, the mortality is also greatest during the hot months; in Paris and Milan, the proportion of deaths in the different seasons is nearly equal.† In this country, we have no data on a sufficiently extended scale to enable us to institute a comparison on this subject. Should these ever be furnished, it will be found, I doubt not, that in our Northern and Middle States, if not everywhere, most persons die of this disease in February, March, and April, or at the close of winter and the beginning of spring.‡ Such at least is the result of my own observations, confirmed by that of many of my most distinguished medical friends.§

No *occupation* is exempt from this disease; but that some employments are more injurious than others, both observation and experience have long since demonstrated. All sedentary pursuits, especially when conducted in crowded and ill-ventilated apartments, are decidedly detrimental. Masons, stone-cutters, carpenters, grinders, painters, and cotton-weavers, are particularly obnoxious to phthisis, probably from the inhalation of irritating matter. Sailors much exposed to wet and cold also suffer considerably; and shoemakers are often affected, from their constrained posture interfering with the natural play of the respiratory organs. Living in moist and filthy situations has a bad tendency; and we have the authority of Dr. Lombard for saying that the poorer classes are twice as liable to phthisis as those in easy circumstances. This remark has reference solely to the inhabitants of Europe, but may be extended, I am inclined to think, to our foreign emigrants, many of whom die of this disease before they have resided many years in the United States.

*Dress* exercises an unfavorable, and oftentimes a highly disastrous influence upon the human frame. Tight lacing especially in young females, must be extremely injurious, from the pressure it exerts upon the tender and delicate organs of the chest, impeding their movements, stinting their growth, and leading to structural derangement. Even when the body has attained its full expansion, stays can seldom be worn without detriment.

Is the popular notion, that phthisis is *contagious*, well founded? This question has often been answered affirmatively, but never, at least so far as I know, in a single instance upon satisfactory evidence. Morgagni was so fully impressed with the idea that the disease is contagious, that he very rarely examined a person that died of it, for fear, as he says, of contracting the infection. Professor Andral, in his commentaries on the treatise of Laennec, without attempting to decide the point at issue, thinks it ought not to be treated

\* Clark on Consumption, p. 175.

† M. Benoiston, Ann. d'Hyg. July, 1831, p. 19.

‡ With respect to the city of New York, actual observation has already proved that the opinion expressed in the text is well founded. From the annual report of interments for 1837, recently published by Dr. Henry G. Dunne, it appears that, of 1458 phthisical subjects, 152 died in February, 159 in March, 163 in April, 133 in May, 123 in June, 101 in July, 109 in August, 119 in September, 72 in October, 88 in November, and 97 in December. Thus about one third of the mortality occurred at the close of the winter and the beginning of spring.

§ See American Journal of the Medical Sciences for May, 1833.

too lightly, alleging that it is by no means easy, in the present state of our knowledge, to give a positive opinion concerning it. Upon this subject I have no personal experience, yet I cannot but believe that the notion about the contagiousness of phthisis is perfectly idle and ill-founded. If, as sometimes happens, the nurses and friends of consumptive patients contract the disease, the circumstance is surely explicable upon other and more philosophical grounds. Loss of sleep, and anxiety of mind, with the attendant impairment of the digestive function, are amongst the most powerful predisposing causes of the disease, and are alone sufficient, in many instances, to kindle it into action. Strong, though not conclusive, testimony in favor of the non-contagious character of phthisis is likewise afforded by the experiments of Hébréard and Lepellatin, of France. These physicians inoculated different animals with pus taken from scrofulous ulcers, without, in a single instance, inducing the disease, or even any particular local derangement. The latter even tried the effects of the matter upon himself, but with no better success. Children have also been inoculated with impunity. Taking all these circumstances into consideration, there is not even a shadow of proof that consumption is contagious. Nevertheless, more extensive and diversified observation is necessary before we can pronounce positively on the subject.

It rarely happens that consumptive patients reach the goal of their existence, without other organs than the lungs becoming seriously involved in the disease. The affections which thus complicate the thoracic lesion may be purely accidental; that is to say, they may supervene during the progress of the complaint without having any direct connection with it; but, in the plurality of cases, they are to be viewed in the light of cause and effect, the presence of the one being necessary to that of the other.

One of the most singular phenomena, and at the same time one of the most common, is the excessive *emaciation*, which has been considered by some, though erroneously, as pathognomonic of the disease. The weight of the body is remarkably diminished; and, with the exception of the glandular structures, the brain, spinal marrow, and nerves, there is not an organ, probably, that does not participate in some degree in the general atrophy. The fat is every where absorbed; muscles are pale, flabby, and attenuated; the cellular tissue is deprived of its moisture; the skin is thin and blanched; the hairs grow slowly, and many of them drop off; the nails are soft and incurvated; the parietes of all the hollow viscera are much reduced in thickness; the bones, although they retain the same length, shrink in circumference, are specifically lighter than natural, and have an unusual degree of whiteness; the marrow is almost wholly removed, and in place of it there is commonly a considerable quantity of oily serosity. Even the cartilages, ligaments, and tendons are in some cases sensibly diminished. The blood also is altered. It is exceedingly thin and pale, from the deficiency of fibrin and hematosine; coagulates imperfectly when drawn; is often buffed, and even cupped. These changes are always more conspicuous, of course, during the latter stages of the disease, in persons who have suffered for a long time. Along with these changes, the whole contour of the body is altered. Every depression is rendered more conspicuous, and every osseous eminence stands out in bold relief. The chest is remarkably altered in shape; it is flat and narrow, instead of being round and protuberant; the intercostal spaces are sunk beyond the level of the ribs, and form long deep grooves; the shoulders are tilted forward; and the clavicles are unusually prominent, leaving a deep hollow between them and the upper ribs. During life, there is a peculiar stoop, which is almost characteristic of the disease.



We have already noticed the changes which take place in the pulmonary tissue. Let us now proceed to examine the lesions of some of the other organs.

The *pleura* is very rarely free from disease. Indeed, this can only be the case so long as the tubercles are few, small, and confined to the interior of the pulmonary tissue; for, as soon as they become numerous, large, and affect the exterior of the organ, they must necessarily act as irritants, and thus lead to structural derangement of the serous investment. Hence we generally find extensive adhesions, both interlobular, costal, diaphragmatic, and even pericardiac. The intervening substance varies in its consistence from that of recent lymph to that of fibro-cartilage, according to the period of its existence. Generally it is pretty thick, and of the nature of cellular tissue, being harder and firmer in some places than in others. When there are large excavations, there are almost always extensive adhesions; tubercles are sometimes disseminated through the false membranes; and, during the latter stages of the disease, the morbid deposit is often accompanied by effusions of serous fluid, the quantity of which varies from a few ounces to several pints. This secretion, there is reason to believe, frequently takes place only a day or two before death. It need scarcely be remarked that, as the superior lobes are usually most affected with tubercles, so they generally adhere most firmly to the walls of the chest.

One of the most distressing accidents which occur during the progress of phthisis, is *perforation* of the *pleura*. This usually takes place suddenly, in the advanced stage of the disease, and almost always destroys life within the first few days, from the violent inflammation that is excited by the extravasation of acrid fluids and the entrance of the atmosphere. In such cases, there is commonly severe pain in the region of the affected part, with much oppression and anxiety. When the symptoms are more mild, life is occasionally protracted for several weeks; and Dr. Stokes, of Dublin, mentions an instance where the patient survived five months. The perforation may happen in either *pleura*, but has hitherto been observed principally in the left side; a circumstance which may be readily explained, by the more frequent occurrence of tubercles in the left than in the right lung.

The *air-passages* are variously affected in phthisis. The ramifications of the bronchiæ, as before stated, are frequently obliterated, very much contracted, or otherwise altered, in their form and dimensions. The mucous membrane of the principal tubes, as well as that of the smaller ones, is generally reddened, opaque, and thickened; occasionally softened, encrusted with specks of lymph, or even ulcerated. Appearances nearly similar are often seen in the trachea; and here it is also more common to find erosions. Occasionally there is extensive destruction of the mucous membrane, with great thickening of the muscular fibres; and, in rare cases, the ulcerative action has been known to produce serious mischief in the cartilaginous rings. The larynx and epiglottis are also frequently studded with ulcers: Louis found them thus affected in one-fifth of his cases, Bayle in one-sixth. Andral\* detected disease, of some kind or other, in as many as three-fourths of his examinations. He also found the muciparous glands often very much enlarged, and the lining membrane variously altered in color and consistence. A not uncommon lesion was a considerable degree of softening.

That the *heart* should be affected in pulmonary consumption, is no more than what might be expected, from its close proximity to the lungs; yet that this does not so often happen as has been imagined, my own dissections war-

\* Clinique Medicale, p. 488.

rant me, I think, in saying. Even in protracted cases, I have frequently been unable, notwithstanding the closest scrutiny, to detect any thing more than a pallid and slightly softened state of the muscular fibres, with an entire absorption of adipous matter. In the great majority of persons examined by Louis, the organ is stated to have been unusually small, being not more than two-thirds of the normal volume. The most common lesion which I have noticed was hypertrophy of the ventricles; and, what is remarkable, this was generally more frequent, as well as more perfectly marked, on the left side than on the right. Occasionally, also, I have observed a diseased state of the mitral and aortic valves; and in some of my examinations, there were numerous flakes of lymph, with partial adhesions of the pericardium, the result evidently of recent inflammation of its serous investment. In a few cases, the pericardium was distended, and pushed out of place by an immense quantity of sero-albuminous matter. The large vessels attached to the heart are usually healthy.

The most common appearance observed in the *peritonæum* is sero-albuminous fluid, which is always most copious when there is disease of the spleen, liver, heart, or mesenteric glands. The phenomenon, however, is extremely rare. The membrane is sometimes thickened, opaque, discolored, or studded with tubercles, in various stages of maturation. A small quantity of thick, cream-colored matter is occasionally found, not unlike what occurs in phlegmonous abscesses.

The *spleen*, in phthisis, is seldom much involved. Louis observed tubercles in one-sixth of his cases; Home in one-fiftieth, or twice in one hundred subjects. From never having found these bodies in persons who died of other diseases, the former of these writers is disposed to consider them as peculiar to this affection. This conclusion is decidedly at variance with my own observations. In four cases, at least, have I witnessed this state of the spleen unconnected with phthisis. An alteration of volume and consistence is by no means infrequent; but whether these pathological conditions are foreign to or dependent upon the present affection, is a point which remains to be settled. My own belief is, that there is no connection whatever between them.

The *liver* is variously affected. In France, the most frequent alteration is the fatty degeneration. Louis established its existence in one-third of his cases of phthisis, whilst he met with it only nine times in two hundred and thirty persons who died of other diseases. He also found it much more common in women than in men, in the proportion nearly of four to one. This state of the liver is probably much more frequent in some localities than in others. In my own dissections, I have rarely met with it; in the examinations of Dr. Home, of Edinburgh, it also occurred comparatively seldom;\* and Dr. Clark† affirms, that it is much less common in England than in France. That peculiar change, called *cirrhosis*, is, according to my own experience, much oftener associated with phthisis than any other. The waxy degeneration, which is probably only an advanced stage of the adipous, and in which the organ acquires a brownish, yellowish color, with a strong resinous lustre, a dense but friable consistence, and a homogeneous aspect, I have never noticed, in a single instance, as a complication of the present disease. The hepatic tissue is sometimes extensively softened; at other times, it is preternaturally firm; whilst, in a third series of cases, though these are very rare, it contains tubercular deposits, serous cysts, hydatids, or carcinomatous growths. With these various alterations, the volume of the liver may be natural, augmented, or diminished. The former I believe to be the most common. The gall-bladder is ordinarily exempt from disease.

\* Report on Phthisis Pulmonalis, op. cit., p. 29

† Op. cit., p. 162.

The *pancreas* is rarely affected in phthisis. I have found tubercles in it only in a single case, — that of a negro boy about nine years old. Louis and Home seem to have entirely overlooked this organ in their examinations.

During the latter stages of phthisis, aphthæ are very apt to appear in the *mouth*. They are generally considered, and I believe correctly, as the immediate forerunners of dissolution; sometimes, however, they exist a considerable time before the occurrence of this event. In many cases they are extremely numerous, covering both the tongue, the inside of the cheeks, and the fauces. Occasionally, though this is rare, they are also observed in the nose, the ears, and even on the vulva. When first seen, they present the appearance of minute chalk-colored specks, resting upon a red florid base. By and by these white crusts fall off, exposing a great number of small ulcers, the primary seat of which is in the muciparous glands. The suffering caused by these aphthæ is sometimes intense. The pharynx and œsophagus are rarely affected in phthisis.

The *stomach* often sympathizes with the disorganization of the lungs. One of the most common lesions is softening, with diminished thickness of the mucous coat. These changes are sometimes produced after death by the action of the gastric juice; but more frequently they are caused by inflammatory irritation, and are usually most conspicuous along the great cul-de-sac of the organ. The mucous membrane is occasionally ulcerated, thickened, extensively reddened, or mammillated. Another lesion that is pretty often met with in Europe, especially in France, but which I have never observed, is great distention of the stomach, the organ reaching sometimes down to the brim of the pelvis. This condition, which is usually accompanied with a blanched and attenuated state of the different tunics, is supposed by Louis to be peculiar to phthisis, as he has very rarely witnessed it in other maladies. On this subject, as just stated, I have no personal experience. One thing, however, appears to me certain, that the explanation of this author, which ascribes the dilatation in question to the effect of the repeated shocks induced by coughing, is wholly inadmissible; otherwise, it would not only be much more common in phthisis, but often attend other thoracic affections.

But of all the organs there is not one which is so frequently or so extensively affected in phthisis as the *alimentary tube*, properly so called. The parts more particularly liable to suffer are the inferior third of the ileum, the cœcum, and the ascending portion of the colon. The most common lesions here by far are ulcerations; indeed it is rare that we examine a subject in which they do not occur in considerable numbers. In the small bowel they are usually situated over the Peyerian glands, which they sometimes entirely destroy, forming large, ragged ulcers, resting upon the muscular fibres. In the large intestine, the erosions occur irregularly, and seldom attain a great size, except when several of them coalesce. The subjoined table, compiled from different sources, will place this subject in a more familiar attitude:

Authors.	No. of Patients.	Locality.	Small Intestine.	Large do.
Bayle,*	200	Paris,	67	
Louis,†	112	„	78	70
Home,‡	66	Edinburgh,	30	38

Tubercles are likewise not uncommon, and there is every reason to believe

\* *Recherches sur la Phthisie Pulmonaire*, p. 59.

† Louis, *op. cit.*, p. 81.

‡ Report on Phthisis, *op. cit.*, p. 28.



that they often form the primary seat of intestinal ulcerations. These bodies, as will be shown hereafter, are usually situated in the submucous cellular substance, where they are sometimes seen in great numbers, either isolated or grouped together. Their occurrence, I presume, is not so common in this country as in France. Louis found them in thirty-six out of ninety-five cases.

It is a pretty common opinion that phthisis frequently gives rise to *anal fistula*, establishing thus, as it were, a sort of an issue, which, by diverting from the affected organ, retards, as is supposed, the progress of the original malady. Respectable as the authority certainly is by which this notion is sanctioned, it is entirely at variance with the experience of every intelligent observer of the present day. The circumstance, I am convinced, is in great measure, if not wholly, accidental; at any rate, I can truly say that it has rarely occurred in my practice, nor have I witnessed it more than three or four times in my dissections of phthisical subjects. Nor do I stand alone in this opinion. The more ample testimony of Laennec,\* Andral, Louis, and Horner,† is equally strong and conclusive. The first of these authors, who treated an immense number of consumptive patients, positively declares that anal fistula was not only very rare in his practice, but that, when present, it seldom exerted any appreciable influence on the progress of the pectoral complaint. Dr. Clark also states that, although he has often met with this affection, he has not been able to trace any connection between it and phthisis, further than its probable dependence on abdominal venous plethora, which so frequently precedes the latter malady.‡ Dr. William A. McDowell, of this city, who has treated a much larger number of consumptive patients than any other practitioner in the valley of the Mississippi, informs me that he has not found the complication in more than three or four cases.

It is seldom that we find the *urinary* and *genital organs* much affected in this disease. In a few instances, I have observed tubercles in the kidneys, the ovaries, the prostate gland, and the seminal vesicles. The uterus is almost invariably sound. On two occasions I have met with ulcers in the urinary bladder, and on one with a small deposit of tubercular matter in the submucous cellular tissue.

It is rare for phthisis to run its course without some of the *lymphatic ganglions* becoming diseased. Those of the mesentery, bronchiæ, and pelvis, appear to be much oftener affected than those of any other region; yet the cervical and axillary are also not unfrequently found in a disordered state. The most common lesion is the tubercular deposit, which is generally conjoined with hypertrophy, induration, and vascular engorgement. In adults, according to my own observations, this heterologous formation is most frequent in the bronchial ganglions; in children and young persons, in the mesenteric, meso-cæcal, and meso-colic. Louis considers the tuberculization of the lymphatic ganglions as peculiar to phthisis; and he even goes so far as to affirm that this morbid change never exists, after the age of fifteen without the lungs being similarly affected. This sweeping assertion has been contradicted by Broussais. It is certainly in opposition to the results of my own experience and that of our best authors.

The *brain* and its envelopes are found in various diseased states. Sometimes there is unnatural vascularity of the cerebral pulp, accompanied occasionally with softening of the fornix and great commissure. Tubercles are also observed in different situations, either solitary in some part of the encephalic mass, or spread generally over the arachnoid membrane, which is not unfrequently opaque and thickened. In many cases there is effusion of limpid fluid, either in the ventricles, or between the arachnoid and pia mater, at the

\* Op. cit.

† Path Anatomy, p. 256.

‡ Op. cit., p. 163.

base or top of the brain. This effusion probably takes place, in most instances, only a short time before death, inasmuch as the intellectual faculties generally remain unimpaired until within a few hours of dissolution.

From the foregoing account it is obvious that the diseases which complicate phthisis are both numerous and distressing. That they are more common in some localities than in others is highly probable; but further researches are needed before we can deduce any satisfactory conclusions in regard to this and some other topics. In the mean time, all our necroscopic examinations should be conducted with the utmost scrutiny, taking care not to overlook a single organ, however distantly it may be connected by structure and sympathy with the suffering viscera; for in this way alone can we hope to add anything substantial to the pathological anatomy of phthisis.

I shall only further illustrate this subject by making a few cursory remarks on the *nature and symptoms* of phthisis. It is not deemed necessary to reiterate here what was said in a previous chapter, concerning the doctrine of the inflammatory origin of tubercle. The subject has been discussed at sufficient length. Since writing that part of the work, I am happy to find that similar views have been promulgated by some of the most eminent pathologists of Europe. That the doctrine of the inflammatory nature of tubercular phthisis will be generally embraced by the profession, it requires, I think, no prophetic vision to foresee. Every one, indeed, who has carefully investigated the subject must be convinced of its truth, and it is only surprising that there should ever have been any other.

Dr. Armstrong and others have expressed the belief that tubercles of the lungs are probably never found without a constitutional or *hereditary predisposition* to them. That such a predisposition frequently exists, and exerts more or less influence over the development of these bodies, it would be unreasonable to doubt; that it is not always present, however, is fully borne out by the general experience of the profession. Persons whose constitutions are perfectly sound, and in no wise tainted by what is called the strumous diathesis, nevertheless often fall victims to pulmonary phthisis, after having labored only a short time under general debility, such as results from a severe attack of bilious fever, typhus, cholera, bronchitis, pneumonitis, profuse hemorrhagic discharges, and other exhausting affections. Thus, although the various organs and textures of the body may have been originally strong and well-built, yet, being worn out by disease, the lungs may finally take on tubercular action, of a character so destructive as to make the whole frame yield to its influence. This is a point, however, upon which it behooves us to speak with caution, as further observation is necessary before we can come to any positive conclusion.

That a morbid condition of the system frequently precedes and accompanies the development of this disease, may be gathered from the foregoing remarks. To this condition of the body various appellations have been applied, such as *tubercular cachexy*, *strumous habit*, and *scrofulous diathesis*. Persons are often born with it; at other times it is acquired, and this may happen during any period of life, from infancy to old age. Those in whom it prevails are generally distinguishable by certain external marks. In one class, which is perhaps the most numerous, the skin is remarkably fair and delicate, the hair light, the countenance full and pasty, the upper lip tumid, the eyes blue, and the lids fringed with long lashes, the expression serene and placid, the mind unusually active, and the nervous system highly excitable. In another class, which may be named the *brunette*, the complexion is dark, the iris of an opake brown, the cornea glistening, the mind dull and sluggish.

Occasionally the skin is extremely fine, the hair of a raven black, and the intellect at once sprightly and intelligent.

Children in whom the tubercular cachexy exists are generally weak and ill-formed. In fact, all the physical functions are imperfectly executed. The circulation is unusually feeble; and hence the extremities, especially the hands and feet, are almost always cold; digestion goes on imperfectly; the bowels are either sluggish or too loose; the urinary and cutaneous secretions are deranged; the muscles are soft and flaccid; the joints appear as if they were too large; the belly is habitually tumid; the head disproportionably bulky; the upper lip unnaturally full; and the countenance has a swollen, sickly, and disgusting aspect. Cutaneous eruptions are not uncommon, especially behind the ears; the eyes are extremely subject to chronic inflammation; and the nose, which is usually dry, from a deficiency of mucous fluid, is the seat of frequent hemorrhages.

With respect to the *diagnostic characters*, phthisis may be divided into three stages, the duration of which is too variable to enable us to lay down any definite rule. In the first stage, the more prominent symptoms are the following: 1, more or less cough, either dry, or attended with thin, frothy expectoration; 2, pain in the side of the chest, at the infra-clavicular region, or between the shoulders, or at all these points simultaneously; 3, hæmoptysis; 4, slight diminution or alteration of the respiratory murmur; 5, dulness of sound in some part or other of the chest on percussion. Along with these phenomena, which may be considered as positively indicating the existence of crude tubercles, there is generally progressive emaciation, loss of strength, capricious appetite, dyspnœa, and great sensibility to atmospheric impressions.

A very important sign of incipient phthisis, one, indeed, that may be regarded as in some degree pathognomonic, was discovered, a few years ago, by that excellent observer, the late Dr. James Jackson, Jr., of Boston, a physician who, had he been spared, would have been an ornament alike to his profession and to his country. While pursuing his studies in Paris, under the guidance of the celebrated Louis, he ascertained that there is always, in the early stage of the present disease, a well-marked bronchial sound on expiration, before the same phenomenon is observable on inspiration, or even before the entire disparition of the breathing murmur. This circumstance, young Jackson supposes, is easily explicable. Although there already exists, at this period, a considerable deposit of solid matter around the bronchia, yet, as the greater portion of the affected lung is still permeable to the air, it follows that the respiratory murmur, on *inspiration*, completely masks the noise of the descending atmosphere, which would otherwise be transmitted through the surrounding denser medium. On expiration, however, the order of things is changed. The air, on passing through the bronchia, produces the same sound as on its introduction; and, as there is now no vesicular expansion to mask it, it is easily transmitted through the diseased structure to the ear of the examiner.\* Other explanations might be offered of this phenomenon, but the one given by its lamented discoverer is at least ingenious, if not strictly true.

In the second stage, the cough becomes more violent and paroxysmal; the expectorated matter, instead of being thin and frothy, is muco-purulent, and often streaked or mixed with blood; the breathing is hurried; the pulse is

\* A Memoir of James Jackson, Jr., M.D., with extracts from his Letters to his Father; and Medical Cases collected by him. By James Jackson, M.D. Boston, 1835, p. 129. We cannot omit this opportunity of expressing the gratification we have received from the perusal of this interesting work. It is a manly and a just tribute from a bereaved father to the memory of a worthy son.



more frequent; the fever is of a hectic character; and the sound on percussion is more dull. Excavations now take the place of the crude tubercles; and hence there are generally, in addition to the phenomena first enumerated, bronchophony, crackling rhonchus, pectoriloquy, and cavernous respiration.

In the third, or concluding stage, there is an aggravation of all the previous symptoms. The emaciation is now excessive; the attacks of dyspnoea are not only more frequent, but often much more distressing, bordering on suffocation: the perspiration is extremely copious, especially towards morning; aphthae appear in different parts of the mouth; the legs and feet are œdematous; and the patient is harassed with constant diarrhoea, which usually persists until dissolution. The latter symptom, which is rarely absent, occasionally manifests itself in an early stage of the disease. It is usually associated with, and dependent upon, intestinal ulcerations. There are two other phenomena which are of a good deal of importance, I conceive, as diagnostic signs of phthisis: I allude to the incurvated state of the finger-nails, and to the glistening, pearly lustre of the sclerotic coat of the eye. The former is sometimes wanting; the latter seldom if ever. Hence it is a symptom of no inconsiderable value.

*Cough* is a very uncertain symptom of phthisis. It is generally most harassing towards the close of life. At first, it is very slight, dry, and short; but, as the disease advances, it becomes more severe, and, in the majority of cases, occurs in distinct paroxysms, which are particularly distressing during the night, or early in the morning. In some instances, it is entirely wanting. Hence its uncertainty as a diagnostic sign.

Much variety obtains with regard to the color, quantity, and consistency of the *expectorated matter*. In the early stage of phthisis, there is either an entire absence of fluid, or it is remarkably scanty, thin, and spumous. At a later period, the quantity considerably increases; but it still retains the whitish, semi-transparent appearance of the bronchial secretion. These characters are observable until softening takes place, and caverns begin to form, when the sputa become streaked with opake specks, from the admixture of broken down tubercular matter,\* and are ejected in distinct, rounded masses, with irregular and indented edges. The color of these masses is somewhat yellowish, with various shades of ash, and even green: they sink, in part, in water, and they are generally enveloped by a thin, ropy, and more transparent fluid, which is nothing but common bronchial mucus. In the concluding stage of the malady, the sputa assume a dirty, cineritious aspect: they are much more tenacious, and they usually run together. The quantity of matter expectorated, varies remarkably in different instances, and is seldom commensurate with the extent of the pulmonary lesion. In rapid cases, from ten to twenty ounces are sometimes discharged in the course of twenty-four hours, even before the disease has made much progress. Occasionally the matter is

\* This matter generally appears in the form of small, whitish, opake flakes, the size of which varies from that of a clover-seed to that of a pea. Hippocrates, who seems to have been acquainted with their existence, compares them to grains of hail, and he distinctly states that they are indicative of pulmonary phthisis. Their appearance, as has been observed by Bayle, resembles a good deal that of boiled rice. According to the recent observations of M. Bonnet, of Lyons, these flakes, which are essentially composed of fibrin, are insoluble in water, in alcohol, or ether. He has also ascertained that the immediate principles of tubercular matter are the same as those which exist in other kinds of pus. An emulsive, fatty substance is often found in the sputa of phthisical subjects; but this is not peculiar to this disease, inasmuch as it forms a part of the secretion of all the mucous membranes, both in health and in disease. M. Bonnet supposes that pus, of whatever nature, always derives from it its opacity and yellowish tinge. — London Medical Gazette, December, 1837. See also an account of Mr. Brett's able paper on the physical and chemical characters of expectorated matter. His results, in the main, agree with those obtained by the French author.

ejected suddenly in large quantities, as when a tubercular abscess gives way ; and, under such circumstances, the patient has been known to be suffocated by it, from his inability to clear the bronchial tubes.

The sputa, especially in the latter stages of the complaint, are generally of a nauseous odor, and at times quite fetid. Their taste is variable ; very often they are quite insipid ; at other times they are saccharine, and, in a few rare cases, saline. Fragments of pulmonary parenchyma, bronchial tubes, and false membrane, similar to that of croup, are sometimes mixed with the ejected matter ; and occasionally, though this is also extremely rare, the patient coughs up small calculous concretions. The sources of the expectorated fluid are three, the bronchial mucous membrane, softened tubercles, and excavations.

Dr. McDowell, who has performed numerous experiments on the subject, informs me that the matter expectorated from tubercular cavities, will, unless very putrid, coagulate on being poured into boiling water, and exhibit the appearance precisely of the solid albumen. Mucus, heated in the same manner, diffuses itself through the water, without materially affecting its transparency. Pus from an abscess of a healthy subject also diffuses itself, but renders the fluid turbid and laetescens.

*Hemoptysis*, on the whole, is rather a frequent symptom. It may take place at any period of the disease, but is most common during the early stages. Sometimes it is the first circumstance which excites alarm. Age and sex appear to exert a considerable influence on the production of hemoptysis. Females are more liable to it than males, in the proportion, according to Louis, of three to two. The former are more commonly attacked after the age of forty, whilst the latter seem to be equally subject to it before and after that period. Hemoptysis is exceedingly rare in infants and children. The quantity of blood varies in different cases, from half an ounce to a pint or more ; in some instances, it merely streaks the sputa, and in others it comes away in large mouthfuls. Several years ago, I saw a case, in which upwards of a gallon was discharged in the course of a few hours. The hemorrhage in this instance, as in almost every other where it is profuse, proceeded from an opening of one of the branches of the pulmonary artery, which had traversed a large excavation in the superior lobe of the right lung. Bayle, Laennec, and Andral have reported similar examples. When less copious, besides the source just mentioned, the blood may be furnished, first, by the bronchial mucous membrane ; secondly, by the air-cells ; and, thirdly, by the parietes of tubercular caverns, the surface of which, as was before intimated, is occasionally thickly studded with minute vascular granulations. The blood of hemoptysis is commonly florid ; occasionally it is dark and clotted ; and at times it is mixed with frothy, mucous, or purulent matter.

*Pain* is another symptom which is not much to be relied upon. It is rarely present in the early stage of the complaint ; and cases occasionally occur in which it is entirely absent. The situations in which it is most commonly observed, are the subclavicular regions, the side of the chest, and the interval between the shoulder-blades. Coughing, deep inspiration, and lying on the affected side, often, though not constantly, increase it. The cause of this symptom is inflammation of the pleura ; for, so long as this membrane remains unaffected, there is generally little or no pain. The dyspnoea, when present — which, however, is not always the case — is usually referred by the patient to the central part of the chest, and is rarely noticed except when he takes exercise.

Although phthisis is generally indicated by well-marked symptoms both of a local and constitutional character, yet cases occasionally occur in which

there are no phenomena whatever by which it is possible to recognize its existence. To such cases, which are by no means infrequent, the term *latent* has been applied. This form of consumption, Dr. Clark thinks, is more common after the middle period of life, — an opinion which is at variance with my own, and the experience of some other writers. Every instance of the kind which has fallen under my observation was under thirty-five years of age.

Various states of the system have a manifest tendency to disguise phthisis. Pregnancy almost always retards its progress, and masks its symptoms. No sooner, however, is the delivery over, than the disease redoubles its vigor, and rapidly advances to a fatal termination. "Persons labouring under consumption rarely abort, though labor pains frequently occur about the seventh or eighth month. A lady, the mother of a very large family, had consumption arrested by eight successive pregnancies. The disease returned in a very marked form after each delivery. As she did not give suck, impregnation speedily recurred, and her temporary comfort was thus insured. Death followed too closely upon her last delivery to admit of the relief which pregnancy in so many previous instances had afforded."\* Diabetes, dyspepsy, and diarrhœa will frequently suspend the influence of this affection, and even cause it to be entirely overlooked both by the patient and by his attendant. Mania occasionally produces the same effect. Dr. Rush† mentions two cases in which madness alternated with phthisis, and for the time wholly suspended every symptom of the thoracic complaint; and numerous cases of a like nature have been recorded by more recent observers. In three cases, which at this moment occur to my recollection, and of which I have kept notes, although the lungs were extensively tuberculized, and in two of the subjects contained pretty large caverns, yet there was not the slightest indication of pulmonary disease during life, not even cough, expectoration, pain in the chest, or embarrassment of breathing. One of the individuals, a colored man, twenty-nine years of age, labored for six weeks under all the symptoms of an ordinary bilious fever, with a pulse seldom higher than ninety-six in a minute. On inspection, I found an excavation of the size of a walnut in each superior lobe, with numerous tubercles in other parts of the organ, and a large abscess between the serous and muscular tunics of the rectum. It contained about half a pint of thick, offensive matter, and its walls were in such a state of softening as to yield to the slightest traction. In the second case, there was extensive ulceration of the mucous membrane of the ileum and colon; and, in the third, that of a young married lady, whose body I examined along with my friend Dr. Richards, of Cincinnati, complete tubercular disorganization of the right kidney. Who can doubt that in these instances the disease of the abdominal and pelvic viscera acted in the manner of a revulsive, counteracting that of the lungs, masking its symptoms, and protracting its progress?

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### SECTION III.

#### DISEASES OF THE PLEURA.

The serous membrane of the chest, like that of the other splanchnic cavities,

\* Ingleby's Practical Treatise on Uterine Hemorrhage, p. 89. London, 1832.

† Med. Inq. and Obs., vol. ii., p. 51. Philadelphia, 1818.



forms a shut sac, which is reflected, on the one hand, over the lung, and, on the other, over the diaphragm and the ribs. Hence the distinction of pulmonary, diaphragmatic, and costal pleura, so frequently referred to by anatomists and pathologists. Inferiorly, this membrane reaches, in front, to the cartilage, of the seventh rib, and, laterally, within an inch and a half of the margin of the sternum; whilst, superiorly, it extends into the neck, forming a narrow pouch, which lies in the hollow between the clavicle, spinal column, and scalene muscles. This portion of the sac, which is designed to receive the apex of the lung, is often from one to two inches in height, especially when one of the respiratory organs is in a state of hypertrophy, to compensate for the partial loss of the other.

In regard to delicacy of structure, the pulmonary pleura considerably exceeds the costal and diaphragmatic, and it is also united by much softer cellular tissue. That this is the case, is abundantly proved, both by anatomical demonstration and by the facility with which this substance is permeated by the air in emphysema, and the water in œdema, — no such appearance being ever perceptible in the subserous cellular texture of the thoracic parietes. Indeed, so great is the quantity of this substance in the latter situation, and so close the aggregation of its component filaments, that Stokes and Cruveilhier are inclined to regard it as of a fibrous nature, — an opinion which is entirely at variance with the result of my own observations. Careful examination has convinced me that the parietal subserous cellular tissue is not fibrous, as is supposed by these distinguished writers, but merely condensed cellular substance, spread out in the form of a lamella, similar, in many respects, to the transverse fascia of the abdomen, so well described by Sir Astley Cooper in his excellent treatise on hernia. Semi-transparent and of a dull whitish aspect, the lamella under consideration is highly extensible and elastic, and, withal, so firm and resisting as to require a good deal of force to tear it. Its thickness, which nowhere exceeds that of a sheet of common writing paper, varies in different portions of its extent, being much greater between the ribs than upon their surfaces, where it is quite thin and delicate. The connection between it and the pleura is so slight, that the latter can in general be easily peeled off in large-sized patches; but, externally, the adhesion is very close and strong, particularly as it passes over the intercostal aponeurosis, from which it can be separated only with a knife or by protracted maceration. On the ribs, this structure, as just remarked, is comparatively thin and spongy, and, in fat individuals, always contains a considerable quantity of adipous matter. Considered in reference to its situation, the lamella here described may be called, with great propriety, the *internal thoracic fascia*. It is much more distinctly developed in the horse and ox than in the human subject, and performs a very important part in all diseases of the pleura, especially in such as are of a chronic kind, in which it often becomes hypertrophied and abnormally dense. It supports the tender ramifications of the vessels, both arterial and venous, as they proceed towards the substance of the serous membrane; and the filaments of which it is composed are interwoven with each other in every possible direction, forming thereby an inextricable network.

In the normal state, the pleura is perfectly colourless, no vessels of any kind being any where perceptible. Nor does it possess much animal sensibility. In several cases in which the chest was punctured by the elder Monro, he introduced a curved probe, and rubbed the point of it against the pleura, without the patient experiencing the slightest pain or uneasiness. He also repeated the experiments of Haller, of pricking and even lacerating the membrane, after removing the intercostal muscles, with precisely the same results.

Although, to the naked eye, the free surface of the pleura is perfectly smooth, yet this is rather apparent than real; for, when carefully examined with the aid of a magnifying-glass, it is found, like the rest of the serous membranes, properly so called, to be studded with an immense number of the most delicate villi, which give it somewhat of a rough aspect. Concerning the precise nature of these minute eminences we have no positive information. In chronic inflammation, they are frequently rendered visible to the naked eye, and impart a rough, gritty sensation to the finger.

Excepting the arachnoid tunic of the brain and spinal cord, none of the serous sacs, in the normal condition, contain any fluid. This, I know, many have doubted; but reiterated examination of the inferior animals, as well as of persons who came to their end by sudden death, has fully persuaded me of the entire truth of the proposition. Naturally the serous textures are lubricated merely by a sort of vapor, which is designed to facilitate the movements of the organs over which they are reflected, and which is evidently an emanation from the capillary vessels distributed through their substance.

With respect to their structure, the serous membranes may be regarded as a modification of the cellular tissue, since they may all be resolved into this substance by different mechanical and chemical processes. They are highly extensible and elastic, and, notwithstanding their tenuity, they possess no inconsiderable share of strength and firmness. By stretching a portion of peritonæum over a hoop, Scarpa found that it did not give way until a weight of fifteen pounds was placed on its surface. Their extensile properties are well displayed in pregnancy, dropsy, and hernial protrusions.

The proper serous membranes are only six in number; 1, the arachnoid tunic of the brain and spinal cord; 2, the lining of the heart and pericardium; 3, the two pleuræ; 4, the peritonæum; 5, the vaginal coat of the testicle. To these some have added the amnios, one of the envelopes of the fœtus, the membrane of Jacob, and certain structures of the internal ear, which all bear a considerable resemblance to the serous tissue, but the precise nature of which is still undetermined.

The diseases that will be treated of in the present section are, inflammation, with its ordinary consequences, and malignant growths. The first of these affections may be acute or chronic, partial or general; that is, it may be limited to a small portion of the pleura, or pervade the entire membrane. Occasionally, too, though this is unusual, it attacks both sacs simultaneously. When the inflammation affects the pulmonary pleura, it often extends to the parenchymatous structure of the lungs; a circumstance which gave rise, amongst the older practitioners, to the opinion that it is impossible for pleuritis ever to have an independent existence. The first writer that controverted this doctrine was Baldi, who published a work on Thoracic Diseases, at Paris, in 1640. A similar view was advanced, about forty years after, by the celebrated Hoffmann; and, in 1740, precisely a century from the period the subject was first broached in France, the question was finally settled by the writings of Triller, a physician of Prussia. Since that time, fact upon fact has been accumulated until the subject no longer admits of dispute.

The anatomical characters of *acute pleuritis* consist in a change of color of the affected membrane, with an increase of its secretion, an altered state of the subserous cellular tissue, and a change in the form and volume of the lung, invested by the inflamed texture.

As soon as the pleura is irritated, the subjacent capillary vessels become injected with red blood, and spread out in every possible direction, anastomosing freely with each other. In this way they form, at first, beautiful dendritic

lines, and afterwards, as the disease progresses, a close and intricate mesh-work, the intervals of which are often much smaller than the most delicate pin-head. The color produced by this capillary injection is usually a bright red; and, although it generally occurs in small patches, with sound portions intervening, yet, in many instances, it is diffused over a considerable extent of surface, occupying the greater part of the entire membrane. In very mild cases, we have sometimes the speckled, dotted, or punctiform redness; as, in those of an opposite character, we sometimes have the blotched, ecchymotic, or blood-shot appearance. In the early stage of the disease, the capillary vessels upon which this discoloration depends, seem to be confined to the subjacent fascia; but, as the inflammation advances to completion, they extend into the substance of the pleura, as any one may convince himself by peeling off this membrane, and inspecting it by the aid of a good glass, or by holding it simply between the eye and the light.

In most cases of acute pleuritis, there is an effusion of serosity into the subserous cellular texture, which may be so great as to give the affected membrane an œdematous aspect. This infiltration, which usually begins at a very early stage of the disease, is always more abundant under the pulmonary than under the costal or diaphragmatic pleura, from the more considerable laxness of the connecting tissue. The serous membrane itself is not at all thickened, though the contrary, I know, has been asserted by numerous pathologists.

In acute pleuritis, as in the corresponding disease of the arachnoid, pericardium, and peritonæum, there usually occurs, in the nascent stage of the complaint, if not an entire suppression, at least a considerable diminution, of the natural secretion; so that the membrane, instead of being moist and lubricated, as in the normal state, is rendered somewhat dry and harsh. But this state continues only for a very short period, when it is followed by an effusion of serum and lymph. Some of the French pathologists suppose that this effusion takes place the very moment the inflammation sets in; or, in other words, that they proceed with equal pace. The truth of this position, however, is by no means established; indeed, it may well be doubted, I think, whether it holds good under any circumstances, further than as an exception to a general rule; for it is satisfactorily ascertained, that a diminution, if not an entire suspension of the exhaling process, is one of the very first effects of acute pleuritis, as it is of acute inflammation of every other serous membrane in the body.

The quantity of fluid poured out in this affection varies from a few drachms to several quarts. Generally thin, watery, and colorless, it is sometimes reddish, and slightly flocculent; or it resembles unclarified whey, and contains masses of lymph, pus, or blood. Occasionally, the fluid is of a yellowish, viscid character, not unlike copal varnish or thin olive oil. An exhalation of pure blood is sometimes witnessed; but this is much more infrequent than in acute pericarditis, or in acute inflammation of the serous membrane of the abdomen.

It is very seldom that genuine pus is secreted in this disease, yet such cases sometimes take place, with very great rapidity. In the winter of 1837, two cases occurred to me, one in a boy, nine years old, and the other in a child of ten months, in both of which upwards of a pint of thick cream-colored matter was found in the pleural cavity after an illness of only about two weeks. Piso relates several instances of acute pleuritis, in which the patients died on the fifteenth, and some even as early as the ninth day, with their chests full of pus; and similar examples are recorded by Andral, Townsend, and other pathologists.



Concurrently with this effusion of serosity, there is a deposition of lymph, either in small globules, in patches, or in continuous layers. At first, this substance is quite soft, so that it can be easily scraped off with the finger-nail; but, after it has existed for a few days, it is found to have a considerable degree of tenacity, and to exhibit the usual manifestations of incipient organization. The precise period at which this process begins cannot be satisfactorily indicated, as it must vary in different cases; as a general proposition, it may be affirmed to be from forty-eight to seventy-two hours from the invasion of the disease. The color of the deposition is usually a pale lemon, but not unfrequently it is a milky white, light grey, or even reddish, from the admixture of blood.

If the inflammation be early arrested, the effused fluid is gradually absorbed, and the contiguous surfaces of the serous membrane, being covered with lymph, are brought into contact, and speedily cemented together. The adhesions thus formed, are at first very slight and easily broken; but in process of time, they are converted into cellular tissue, and become proportionally strong and resisting. When extensive, they often greatly embarrass the movements of the lungs, at the same time that they exert a very serious influence upon the size and figure of the chest.

If, on the other hand, the disease be allowed to progress, until the effusion amounts to several quarts, it requires to be let out by puncturing the chest, the absorbents being no longer capable of taking it up. The wound thus made occasionally heals kindly; and, if the fluid does not reaccumulate, the patient has a chance of getting well, the parts contracting adhesions, as in the preceding case, and the lung becoming again dilated by the introduction of the air. It deserves to be mentioned that, when the quantity of fluid is considerable, the adventitious membranes are apt to be quite thick, and to have their outer surface pitted like a honeycomb. Of the manner in which the lung is affected in this disease, mention will be made under the head of chronic pleuritis.

*Gangrene* is one of the rarest results of acute pleuritis. As a primary affection, I have never seen an instance, and Laennec met only with a single case in the whole of his long experience. Nor have others been more successful. Most commonly it is produced by external violence, and occasionally it is propagated from the pulmonary tissue. The affected parts may be readily distinguished by their softened, pulpy condition, by their dark greyish, brownish, or blackish color, and by their disagreeable, fœtid odor. In some instances, the affection appears to begin in the adventitious membranes, from whence it gradually spreads to the other structures, such as the pleura, the lungs, intercostal muscles, and even the ribs.

The *symptoms* of acute pleuritis are much influenced by the extent of the disease, and by the length of time it has existed. In general, there is inflammatory fever, with violent pain in the side, dyspnœa, hard, dry cough, and inability to lie on the affected side. Having lasted for a day or two, these phenomena are followed by others, such as dulness of sound on percussion, bronchial respiration, a peculiar modification of the voice, and, finally, complete absence of the respiratory murmur.

The pain is usually circumscribed, no matter what may be the extent of the inflammation, and is of a sharp, stitch-like character, increased by coughing, by deep inspiration, by pressure on the intercostal spaces, or by lying on the affected side. The situation where it is most commonly felt is the mammary region, whence it often shoots along the axilla, the clavicle, top of the shoulder, upper part of the back, or even the arm and fore-arm. In the latter case, the pain seems to be reflected along the course of the intercosto-humeral nerves, from their participating, probably, in the disease of the serous lining of the chest, immediately beneath which they lie.

In acute pleuritis, the countenance is generally expressive of deep suffering, and the respiration is short, hurried, and jerky, from the inability which the patient experiences in inflating the lungs. These phenomena, together with the dry, hacking cough, and the sharp, lancinating pain, may be regarded as pathognomonic of the disease.

When acute inflammation of the serous membrane of the chest continues beyond a few weeks, it becomes chronic; but it is by no means always thus preceded; for, in many instances, it exists as an original affection, stealing on in a slow and almost insensible manner. In whatever way, however, it may arise, the anatomical characters do not differ essentially in the two diseases, especially as far as the effusions are concerned.

In *chronic pleuritis*, the membrane acquires a slight degree of morbid thickening, its color is of a more obscure red, and the subserous cellular tissue is hypertrophied and indurated. This, however, is not always the case; for, in some instances I have found this substance so soft and brittle that the pleura could be peeled off, almost entire, with the utmost facility. The effusion, which is generally much more abundant, as well as less limpid, than in the acute disease, is almost always mixed with lymph. Hence, when evacuated, and allowed to stand at rest, it usually separates into two parts; one thin and viscid, like serum, floating on top; the other, which consists of fragments of albumen and serum, sinking to the bottom. Most commonly, perhaps, the effusion is of a light lemon color, of the consistence of thin oil, and destitute, or nearly so, of odor. Frequently, however, it is of a dark greenish hue, sero-purulent, and almost insupportably offensive. Cases also occur in which it contains blood, and now and then it is strictly purulent, possessing all the properties of genuine pus. The quantity of effused fluid is sometimes almost incredible. In a subject, fifty-two years old, I drew fully two gallons of sero-purulent matter, not long ago, from the right pleural sac: it was of a white yellowish color, and intolerably offensive. Occasionally, when the distension is very great, the fluid has a tendency to work its way out, either through the bronchial tubes, through the intercostal spaces, or even through the diaphragm. Of the latter mode of escape, an interesting case is given by Andral, and another by Le Dran, in his surgical observations. When the patient survives, as sometimes happens, the passage along which the pus travels is lined with an adventitious membrane, like fistulous tracks in other parts of the body.

The adventitious membranes of chronic pleuritis do not materially differ from those produced by the acute form of the disease, excepting that they are generally thicker, more extensive, denser, and more firm. They often consist of a number of distinct layers, the outer of which are always much softer than the internal, or those which are formed first. I have repeatedly seen from three to five such lamellæ; and, on several occasions, it has occurred to me to meet with small compartments, formed by sheets of lymph, and filled with a thin, glairy fluid, not unlike the white of egg. Occasionally these cavities contain thick pus, and even pure blood. Soon after their deposition, these false membranes become organized, and consequently subject to the same diseases as the natural tissues; for example, to the effusion of serosity, lymph, pus, or blood, gangrene, tubercles, and, lastly, fibrous, cartilaginous, and osseous transformations. Their vascularity is sometimes very considerable, as is shown by the red dots upon their free surface, as well as by the clots of blood found in their cavities. Thus, then, when these abnormal textures are organized, it is sufficiently clear, from what has been stated, that they perform the office of secretion; and, from the fact that the effused fluids sometimes entirely disappear, it is equally manifest that they possess, in a very eminent degree, the faculty of absorption.

These false membranes are sometimes converted into cysts, filled with tubercular matter. This was the case with a man, thirty-three years of age,

Fig. 126.



whose body I examined in March, 1844, at the Marine Hospital of this city. His death was occasioned by pulmonary phthisis. On the convex part of the right lung, at the junction of the middle and inferior lobes, was a stroug, white bag, of an elongated oval shape, two inches and a half in length, by one inch and three-quarters in width; it fluctuated under the finger, and was occupied with soft yellowish tubercular matter. Of a dense fibrous structure, it was about half a line thick, and adhered with great firmness to the outer surface of the pleura. The parts immediately around it had a remarkably puckered aspect, and were traversed by numerous vessels, some of which extended into the abnormal pouch. Fig. 126 represents the cyst with a portion of its contents exposed by an incision. A similar specimen is contained in the museum of the Institute.

Small bony *concretions*, very much like those of the joints, are sometimes found floating loosely about in the effusion. How these bodies originate has long been a problem with pathologists; the most plausible explanation, perhaps, that can be offered concerning them, is to suppose that they are attached, at first, to the surface of the pleura, in the form of fibrin; secondly, that they are organized; thirdly, that their nutrition being perverted, bony matter is deposited; and, fourthly, that, after this process has continued for some length of time, the vessels supplying them are obliterated, in consequence of which they drop off. Instead of being osseous, these concretions may be of a fibrous, fibro-cartilaginous, or gristly consistence, and of a white pearly color, with a tolerably smooth surface.

*Gases* sometimes accumulate in the chest, being either secreted there by the serous membrane, generated by the decomposition of effused fluids, or introduced from without in consequence of a wound, a fistulous aperture, or the bursting of a tubercle. In the two former cases they often have the odor of sulphureted hydrogen, and, on the chest being punctured, escape with a loud hissing noise. When very abundant, these gases seem to be incapable of absorption; and their presence, therefore, may occasionally become a source of much inconvenience, by the pressure which they exert upon the lungs. Dr. Davy, of Edinburgh, has analyzed the air collected from a patient who died of *pneumo-thorax*, and found the following proportions: carbonic acid, 12.5; nitrogen, 85.5; oxygen, 2. Professor Apjohn, of Dublin, in a similar experiment, found, in one hundred parts, 8 of carbonic acid, 10 of oxygen, and 82 of nitrogen.



*Ulceration* of the pleura, though occasionally observed, is to be considered as very rare. I have witnessed only a single instance of it. The patient was a female, fifty-five years of age, who died of hydro-thorax, complicated with pulmonary tubercles. On opening the chest, which contained an immense quantity of sero-purulent effusion, five ulcers, of an oval shape, were seen upon the left costal pleura, the largest of which was about an inch and a half in diameter: their surface, formed by the subserous cellular tissue, was bathed with bloody matter, and their edges were red, indurated, and slightly everted. The parts around were of a brownish color, deeply injected, and considerably incrustated with lymph. The lung contained hundreds of tubercles, in every stage of development; in the upper lobe was a large excavation, the margins of which firmly adhered around the principal ulcer of the pleura. Such erosions, perhaps, seldom or never heal. In fact, it is doubtful whether they are susceptible of it.

Another affection which is sometimes noticed, and which is also very rare, is *ossification* of the pleura. The bony matter, which usually appears in thin, narrow plates, is probably always preceded by cartilage, as is shown by the fact that these substances often occur together, the former being encircled by the latter. Laennec states that he once met with a cartilaginous incrustation of the serous membrane of the chest as large as the hand, and more than half an inch thick in the centre. The costal pleura seems to be the part most frequently affected by these transformations, though the pulmonary and diaphragmatic portions are not exempt from them. Their original seat is the subserous cellular tissue, the involvement of the serous membrane itself being entirely secondary.

*Tubercles* are also rarely met with, — seldom, if ever, except in connection with adventitious membranes and serous effusions. I have seen two instances of this disease, in both of which the tubercles were very large, — most of them of the size of a pea, of an opaque, whitish appearance, and surrounded by inspissated lymph: they adhered with great firmness to the costal pleura, which was itself considerably thickened, and they were almost of a fibro-cartilaginous consistence. Laennec, who supposes that these bodies generally originate in the false membranes, describes them as varying in size from a millet-seed to a hemp-seed; as being of a greyish or yellowish color, semi-transparent or opaque; and as lying in close proximity to each other, with the intervening structure in a state of high vascularity. The tubercles are sometimes developed with great rapidity. Thus, Andral states that he has seen the abnormal membranes studded with these bodies in persons who died of acute pleuritis of only fifteen days' standing.

Scirrhus and encephaloid are sometimes found in the pleura; but their occurrence is so very unusual that it is unnecessary to say anything about them in this place. The same remark may be made respecting those cysts which have occasionally been noticed in this situation, and of which such an interesting case has been given by Dupuytren.\*

The *lung*, as might be anticipated, is variously affected in pleuritis, both acute and chronic. When the effusion is very considerable, the organ may be so much compressed, that, without a careful examination, it might be regarded as totally destroyed. I have repeatedly seen it reduced to the smallest possible size, lying like a thin cake, scarcely bigger than a child's hand, in the back part of the chest, beside the spinal column. When thus atrophied, the parenchymatous texture is hard and dense, void of crepitus, pale, and almost

\* Cruveilhier, *Essai sur l'Anatomie Path.*, Paris, 1816.

bloodless, the vessels being flattened, and, in some instances, partially obliterated. If the lung continue in this state for a considerable period, it becomes hepatized, or, as is more generally the case, tuberculized, and entirely unfitted for the purposes of respiration. On the contrary, should the fluid which has occasioned the compression be speedily absorbed, the pulmonary tissue will gradually expand, and finally be as pervious to the air as ever. The only exception to this rule, so far as I know, is where the organ is tied firmly down, by shreds and layers of lymph, in the hollow between the spine and ribs; in which case it will remain permanently strangulated.

Nor is the alteration confined to the lung. Whenever the effusion is great, the affected side becomes manifestly larger; the intercostal spaces being not only remarkably wide, but projecting occasionally considerably beyond the level of the ribs. The diaphragm, also, is more or less depressed, and the heart is often thrust from its natural situation, either to one side, or down into the epigastric region. The extent of the dilatation varies in different cases, but does not in general exceed two inches. The best way of ascertaining how much enlargement there is, is to adopt the plan suggested by Dr. Townsend, of Dublin, which consists in measuring both sides with a tape, carried from a central point in the sternum under the mamma to the spinous process of the corresponding vertebra. The eye alone, however, is often quite sufficient to detect the difference, even when it amounts only to six or eight lines.

Sometimes the reverse of this phenomenon is observed, the chest, instead of being dilated, being considerably contracted. This diminution, which results from the complete absorption of the effused fluid, and from the conversion of the adventitious membranes into fibrous, cartilaginous or bony matter, is generally accompanied by a loss of resonance in the affected side, and by a very marked alteration of the respiratory murmur, — effects which usually continue for a long period after the cure of the disease, and not unfrequently during the remainder of the patient's life. A very rapid contraction of the chest sometimes takes place after the operation for empyema. Dr. Townsend mentions the case of an individual, aged twenty years, in whom, in the space of nine days, the circumference of the diseased side diminished nearly three inches by the falling in of its osseous parietes.

*Chronic pleuritis*, as has been already stated, is the consequence, most generally, of the acute form of the disease; yet sometimes it is primary, and then its approaches are often so obscurely marked that it may have existed for a considerable length of time, and extensive effusion taken place, before the patient is led to suspect the slightest mischief. When chronic pleuritis is the relie of acute, the individual does not gradually or suddenly regain his health as is usual after active depletion; on the contrary, he remains weakly, feels some oppression in the chest on lying down, experiences shortness of breath on ascending a flight of stairs, and has a slow fever at night, followed, towards morning, by copious perspiration. The cough is irregular, short, and tickling, and the pain is commonly not severe, the stitch which marks the acute disease being seldom present, or, if present, only occasional in its occurrence. Sometimes, indeed, the disorder may be said, so far as this symptom is concerned, to be perfectly latent, the pleura being greatly disorganized, and even profoundly suppurated, without the person having ever complained of the least pain. Baglivi and Morgagni have transmitted the history of several cases of this kind; and similar testimony is borne by numerous writers of a more recent date. This is an important fact, which renders it highly imperative upon us always to watch our patients after an attack of acute inflammation, and not to neglect the stethoscope whenever there is the slightest suspicion of lurking disease.

When the individual laboring under chronic pleuritis sits up he is often free from any marked inconvenience ; but no sooner is he asked a succession of questions, or requested to cough, or to walk across the room, than the chest begins to heave, the respiration becomes hurried, and there is a sense of tightness and oppression, from which it will take him some time to recover. Firm pressure on the abdomen or on the affected side will produce the same result. But one of the most remarkable symptoms in chronic inflammation is the position which the patient assumes in bed : in the acute disease, he almost invariably lies on the sound side ; in that under consideration, on the contrary, he lies on the affected side, on the back, or in an intermediate posture.

Such are the more prominent phenomenon which denote the existence of chronic pleuritis. It only remains for me, therefore, in connection with this topic, to speak of the physical signs of this malady ; a subject which has been so happily elucidated by the labors of Laennec, that little has been left to be done by succeeding pathologists. These signs, which are to be drawn from a stethoscopic examination of the patient, do not differ in any respect in the two forms of the disease which we have been considering, except that in the chronic there is less frequently that shrill, jerky, tremulous sound, which, from its resemblance to the voice of the goat, has received the name of *agophony*.

In the early stage of pleuritis there are no physical signs to indicate its existence ; but, as soon as the effusion has taken place they become at once prominent and expressive. Thus, when a stratum of liquid intervenes between the lungs and the walls of the chest, there must necessarily be dulness on percussion, with diminution or absence of the respiratory murmur. This will be the case even when the quantity of effusion is small ; but, should it be abundant, the lungs will be greatly compressed, and the respiration be bronchial, from the fact that the air can no longer gain admission into the vesicular structure.

The dull sound is, in most cases, originally observed at the inferior part of the affected side, from whence it gradually ascends as the effusion becomes more copious ; and as it changes, likewise, with the position of the patient, it thus determines very accurately the level of the extravasated fluid. The principal exceptions to this rule are, where the lungs have contracted extensive adhesions, and the fluid occupies almost the entire cavity of the thorax. Examples of these occurrences are not unfrequently met with in our dissections. In the fifth volume of the Dublin Hospital Reports two remarkable instances of empyema are detailed by Professor Stokes, in both of which the lungs were attached from their summit to their base by a vertical adhesion of several inches in breadth. Similar instances have been published by other writers, and of the influence which they exert over the physical indications of pleuritis every one must be fully aware. Dulness of sound alone cannot be regarded as pathognomonic of the disease, as it may arise from other causes than from effused fluid ; for example, from hepatization of the lungs, or from an excessive development of tubercles ; still it should never be overlooked, inasmuch as, when taken in connection with other signs presently to be noticed, it will much aid our diagnosis.

The alteration of the respiratory murmur is always in direct ratio to the thoracic effusion, being deep and feeble when the quantity of fluid is moderate, but entirely wanting when it is very abundant, except along the spinal column, where it is still somewhat audible over a space of a few inches in breadth. Sometimes the respiratory murmur survives the dulness of sound for several days ; and, not the least remarkable circumstance connected with this subject, is, that the crepitation after having ceased in all other parts, ex-



cept along the dorsal vertebræ, often continues to be heard under the clavicle, from the adhesions between the pulmonary and costal pleura in this situation in phthisis. This continuance of the breathing murmur towards the root and apex of the lungs, with its disappearance, either gradually or suddenly, from other parts of the organ, is generally sufficient to distinguish pleuritis from inflammation of the substance of the lung, in which the diminution or absence of this sound is invariably preceded by what is termed the crepitating rhonchus, and in which are ordinarily to be observed traces of the admission and expulsion of air.\*

Another physical sign we may sometimes recognize in pleuritis, especially in the acute form of the malady, is a peculiar *friction sound*, not unlike what is produced by rubbing against each other two pieces of sole-leather. The cause upon which this depends is easily explained. In the normal state the contiguous surfaces of the pulmonary and costal portions of the pleura are constantly bedewed with a thin, viscid exhalation, by which they are enabled to glide smoothly and imperceptibly over each other; but, as soon as they become inflamed, they pour out plastic lymph, which adheres to them in different places, and renders them so rough as to thwart their physiological object. Thus the movements of the lung are materially impeded, and the sound which attends them is heard both during inspiration and expiration. We need scarcely remark that this sign can only be detected so long as there is no effusion of serosity. Hence it is usually most distinct in the early stage of the disease, or after the accumulated fluid has been absorbed.

Ægophony is commonly most distinct towards the inferior parts of the chest, in the interval between the nipple and spine; but it changes its place whenever the patient assumes a different position, and seems constantly to follow the upper level of the fluid. It does not exist either in the very early or in the more advanced stage of pleuritis; is heard only so long as the effusion is moderate, or a few lines in depth; disappears when it becomes more abundant; reappears when it diminishes; and finally ceases altogether, when it is absorbed. This phenomenon, considered by some writers, though erroneously, as pathognomonic of pleuritis, has been variously accounted for. Laennec ascribes it to the transmission of the voice through the compressed lung and the fluid which is interposed between this organ and the wall of the chest; whilst others, with more plausibility, suppose that it depends upon the air not penetrating beyond the larger bronchial tubes, — an opinion which is strengthened by the fact just mentioned, that, whenever the quantity of effusion is so great as to exert a considerable degree of pressure upon the pulmonary tissue, the ægophony is entirely absent, reappearing as the matter is absorbed and the pressure diminishes.

Besides these signs, which may be regarded as unequivocal evidences of pleuritis, fluctuation can often be distinctly felt through the intercostal spaces; and, on some occasions, a plashing noise is to be heard within the chest, resembling that produced by agitating a cask partly filled with water. Another test of thoracic effusion, first suggested, I believe, by Bichat, is the effect of pressure on the corresponding side of the abdomen. The diaphragm, with the fluid resting upon its upper surface, is thus thrust into the chest, and the lung being greatly compressed, an insupportable sense of suffocation is produced. The value of this test, however, has been recently disputed by Chomel and Townsend, who assert that in most of the cases in which they have employed it, the result was the very opposite to that just stated. Important

\* Laennec on Auscultation, p. 65.

diagnostic signs may also be drawn from the figure of the chest, and from the fixed position which the ribs assume when this cavity is much dilated or contracted.

When the effusion is combined with gaseous matter, or when the latter exists alone, the physical signs are very nearly as they have just been described, excepting that there is often a remarkable tympanitic clearness on percussion, and a peculiar metallic tinkling during the act of respiration. This sound, which resembles that of the Jews-harp, may also be easily imitated by the dropping of a pin into a tumbler, or by touching gently a sonorous vessel with a quill.

## CHAPTER XVII.

### OF THE HEART AND ITS MEMBRANES.

#### SECTION I.

##### OF THE PERICARDIUM.

I. *Lesions of the Pericardium.* — Inflammation. — Hydro-pericardium. — Formation of Matter and Deposits of Lymph. — Symptoms. — Effusion of Blood. — Accumulation of Air. — Serous Cysts. — Congenital Absence. — II. *Lesions of the Heart.* — Situation, Shape, Color, Weight, and Dimensions. — Cardiac Sounds. — Capacity of the opposite Reservoirs. — Structure. — Malformations. — Acute Carditis. — Collections of Pus. — Ulceration. — Inflammation seldom or never ends in Gangrene. — Softening. — Induration. — Cartilaginous and Osseous Degenerations. — Scirrhus and Enecephaloid. — Fatty Transformation. — Sanguineous Effusions. — Serous Cysts. — Hydatids. — Atrophy. — Dilatation. — Aneurism. — Hypertrophy. — III. *Lesions of the Endocardium.* — Acute Inflammation. — Thickening. — Wart-like Exerescences. — Fibro-Cartilaginous, Cartilaginous, and Osseous Transformations. — Fibrinous Concretions.

THE first disease of which we shall speak is *pericarditis*. This is unquestionably of much more frequent occurrence than is generally supposed by the profession. Most commonly induced by vicissitudes of temperature, and by external violence, it often exists in combination with rheumatic affections of the fibrous tissues, with pneumonitis, pleurisy, and the autumnal remittent fevers of the United States and other countries. In the acute variety of the disorder, the leading anatomical characters which are to be observed in such as die, are, preternatural redness of the lining membrane, effusion of serum, and exudation of lymph.

It is rare to find the redness very bright; most generally it inclines to a purple or light brownish tint. Presenting itself under a great variety of forms, it is sometimes seen in small dots, sometimes in arborescent lines, sometimes in considerable patches. In all these cases, the surface of the pericardium has a mottled appearance, from the intervening portions of the membrane retaining their natural color. Not unfrequently, however, the part is almost free from this — the vascularity, even when the inflammation is very intense, being extremely slight, or having so far disappeared, when the inspection is made, as to be scarcely visible. The redness is seldom uniformly diffused over the whole bag; when this happens, the inner surface exhibits a stained appearance, as if the color had been dyed into it.

When the disease becomes chronic, or is so from the onset, the redness diminishes in intensity, and assumes a mahogany, brownish, fawn, or cinnamon tint. The effused lymph, of which we shall presently speak, often ac-

quires the same color, and the heart itself is usually of a bluish-white appearance. Neither in this, nor in the acute variety of the disease, does the serous membrane undergo much change. Its thickness and consistence are precisely as in health; and although its surface is often roughened, yet this is altogether an adventitious circumstance, produced by the deposition of lymph.

Soon after the disease is fairly established, the lining membrane pours out a thin, *watery fluid*, either of a clear limpid appearance, or of a light citron color, slightly inclining to greenish. This fluid is coagulable by heat, alcohol or acids, and is to be regarded simply as an increase of the natural secretion. In many cases, it contains fragments of lymph; in others, it is mixed with pus, or even with pure blood: or all these substances are found at the same time. The effusion of blood is always indicative of high inflammatory irritation: it may be a simple exhalation from the lining membrane, or it may proceed from a rupture of some of its vessels. The quantity of serum thrown out during the first two, three, or four days, is generally considerable, amounting often to ten or fifteen ounces. After this, as the violence of the disease subsides, it gradually disappears by absorption, so that in the course of a week or two scarcely any of it is left. In chronic pericarditis, the serum has usually a singularly lactescent, puriform character, and is much smaller in quantity than in the acute form of the disease. When the fluid remains unabsorbed, it gives rise to what is called *hydro-pericarditis*. The quantity in such cases is sometimes very great. Corvisart\* relates one in which it amounted to eight pounds.

The quantity of *purulent matter* thrown out in chronic pericarditis is sometimes astonishingly great. In the case of a colored man, thirty years old, mentioned by Dr. Wright† of Baltimore, it is said to have exceeded a gallon. It was of a uniform consistence, and a light yellowish color, exhibiting all the qualities of laudable pus. The pericardium, from the lining membrane of which this immense accumulation of matter proceeded, was excessively dilated, and both lungs were in consequence thrust high up into the thoracic cavities. The heart was of the ordinary size, and not particularly diseased. In the acute form of the complaint, pus is rarely observed, and never to so great an extent as in the chronic.

Contemporaneously with the effusion of serous fluid is the exudation of lymph, which is at first of a pale straw color, and of a soft, viscid consistence, but in a short time acquires a light greyish, opaline tint, and a firm tenacious character. Though occasionally deposited in small, detached patches, it commonly forms a continuous layer, which is spread over the opposing surfaces of the pericardium, both on the heart and on the origin and termination of the great vessels. The thickness of the false membrane seldom exceeds a line, from which it may vary, in some instances, to nearly an inch, being generally much more considerable than the false membrane of pleuritis. The adherent surface is smooth, and accurately adapted to the parts upon which it reposes; the other is rough, flocculent, and often marked with small depressions, which give it a singularly reticulated aspect, not unlike a piece of lace-work, a sponge, or a honey-comb. This appearance, which is seen only in recent cases, results from the incessant movements of the heart, and may be pretty closely imitated by pulling apart two plates united by a thick layer of butter.

After this membrane has been for some time formed, it becomes vascularized, — vessels shooting into it from the surrounding parts in the same manner as

\* Organic Diseases of the Heart, p. 63. Philadelphia, 1812.

† American Journal of the Medical Sciences, vol. xii, p. 33.



in the adventitious structures in other situations. In this way it may become the seat of subsequent attacks of inflammation, or of tubercles and various other transformations. Whilst the process of organization is going on, the exudation is gradually deprived of its more fluid ingredients, until at length it is completely converted into dense, greyish cellular tissue, cementing the contiguous surfaces closely and inseparably together. Of this I have seen quite a number of specimens. When the lymph is very thick, it sometimes assumes a laminated arrangement; in other cases, it is drawn out into transverse wrinkles, or into long, slender filaments.

In chronic pericarditis, the false membrane sometimes contains plates of cartilage, and even small specks of bone. Occasionally we meet with compartments, filled with pus, serum, or puriform fluid; and cases also occur, and this not unfrequently, in which the lymph is studded with tubercles. In a preparation which I took from the body of a colored man, ninety years old, the adventitious membrane, about a third of an inch thick, contains from fifteen to twenty of these bodies, some of which are as large as a common cherry-stone. They are of a light straw color, quite hard and dense in their texture, and firmly embedded in the substance of the abnormal tissue.

The muscular substance of the heart, in this disease, often remains wholly free from inflammation; sometimes, however, it is found to be considerably changed in its color and consistence, — circumstances which would lead us to infer that it had participated in the derangement of its investing membrane. The organ is, in some instances, partially atrophied, from the pressure, probably, which it suffers from the effused fluid. When it has been long united with the pericardium by lymph, it is not uncommon to find hypertrophy and dilatation of the ventricles, with ossification of some of the valves, and softening of the muscular tissue. These disorders are brought about, no doubt, by the great exertions which the heart is obliged to make, in consequence of its restrained and shackled condition. Unable to act with its accustomed freedom, its fleshy fibres are in a state of constant congestion, and its chambers in a state of constant distention; whence results, on the one hand hypertrophy, and on the other dilatation of the auricles and ventricles.

Pericarditis has been observed at all periods of life, though it is undoubtedly most common after the age of forty, in persons who are naturally predisposed to gouty and rheumatic affections. Billard was led to suppose that it occurs most frequently in new-born infants. In seven hundred autopsic examinations, made at the Foundling Hospital of Paris, he observed seven well-marked cases of this disease, two of which proved fatal in less than forty-eight hours after birth. In one of the children who died thus early, the adhesions between the pericardium and the heart were so strong as to lead to the belief that the malady had existed for some time prior to birth. In the other six cases, the adhesions were much weaker, and there was also a considerable quantity of sero-albuminous effusion.\* Pericarditis, at this tender age, generally runs its course with great rapidity, and without affording any signs which can be considered as at all diagnostic. The little patients appear to suffer violent pains, the respiration is greatly embarrassed, the muscles of the face are continually contracted, and there are occasional paroxysms of impending suffocation.

“There are few diseases,” says Laennec, “attended by more variable *symptoms*, or of more difficult diagnosis, than pericarditis. Sometimes it appears with all the symptoms of a very violent disease of the chest, obviously calculated to carry off the patient in a few days. At other times, it proves fatal without

\* *Traite des Maladies des Enfants Nouveaux-nés*, p. 624. Paris, 1837.

leading us in the least to suspect its existence. Again, we find cases marked by all the symptoms usually attributed by pathologists to this disease, and in the subjects of which, after death, we discover no traces of its presence. I have myself," continues this celebrated individual, "frequently fallen into both errors, and I have seen the same thing happen to the most skilful practitioners."\* One of the great difficulties connected with the diagnosis of this affection, is the circumstance of its being generally complicated with pleuritis, inflammation of the lungs, or some other thoracic disorder, which masks its peculiar character, and deceives the physician.

The pain in acute pericarditis is generally of a pungent, burning, lancinating kind, and, as in acute pleuritis, often extends to the top of the shoulder and upper-arm: it is augmented by a full inspiration, by stretching the left side, or by pressure over the præcordial region or between the fifth and sixth ribs. The patient lies almost always on his back; he is harassed with a dry, hacking cough; the respiration is hurried and irregular; the countenance is expressive of deep anxiety; the features are contracted; there is cardiac palpitation, with a peculiar disposition to faintness; and the pulse is always frequent, and generally, at the onset, full, hard, and jerky, the stream of blood being sent with a peculiar thrill. This state of the artery, however, usually continues only for a few days, when the pulse becomes very small and frequent, or even imperceptible.

In some instances, a sound similar to the creaking of new leather is heard, which, however, seldom lasts longer than a few hours, and cannot therefore be considered as of much value. Very recently, Dr. Watson, of London, has called attention to a symptom which, in most cases, furnishes a certain ground of diagnosis. It consists in a *superficial murmur*, heard equally during the systole and diastole of the ventricle. This murmur appears to be produced by the rubbing of the contiguous surfaces of the pericardium, roughened by lymph, and is designated by Dr. Watson by the term *to and fro sound*. The noise is not always to be recognized, however, with the same degree of distinctness: it is loudest when there is no serous effusion, and often entirely disappears when the quantity of fluid is great, becoming again audible as it diminishes. In this respect, it is analogous to ægophony. Very generally a systolic murmur is also heard, produced, it is probable, by a roughened state of the valves.

When there is much accumulation of fluid, whether in consequence of acute or of chronic pericarditis, the præcordial region sounds dull on percussion, and often becomes preternaturally prominent, in the same manner as the thorax does in pleuritic effusion. The projection is sometimes evident over a space of four or five inches in length, by three and a half in breadth. The pulsations of the heart, often perceptible on inspection, are always irregular, tumultuous, and obscure. If, with these phenomena, the patient is unable to lie on his back without being threatened with instant suffocation, and is subject to frequent paroxysms of swooning, no doubt can be entertained of the true nature of the complaint.

It is surprising how large a quantity of fluid may occasionally exist in the pericardium, and yet the patient scarcely manifests any symptoms of uneasiness. In the case detailed by Dr. Wright, previously adverted to, although the pus amounted to four quarts, there was not the slightest appearance of impeded cardiac action; the pulse was free, moderately full, and regular; there was no embarrassment of breathing, no distress of countenance, no syncope, no præ-

\* Treatise on Thoracic Diseases, by Forbes, p. 675.

cordial pain, no œdema of the extremities. The patient could lie equally well on both sides, and the day before he died walked about the wards of the hospital with apparent ease. The formation and accumulation of this immense quantity of purulent fluid were obviously the work of time, and had commenced long before the man's last illness.

The signs of adhesion of the pericardium are generally very obscure. Perhaps the most characteristic symptom is an abrupt, jogging motion of the heart, recognizable by the hand or stethoscope placed over the præcordial region. When the lesion is joined with hypertrophy of the left ventricle, a bellows-murmur is occasionally heard, and not unfrequently the apex of the organ strikes with so much violence against the costal cartilages as to produce a marked prominence.

We have already mentioned, that, in cases of violent pericarditis, there is sometimes an effusion of pure *blood*. In most cases, the fluid, amounting frequently to upwards of a quart, is coagulated; occasionally, however, it is liquid, exceedingly dark, and almost destitute of fibrin. On examining the pericardium, in persons who succumb under this lesion, it is generally impossible, after the most diligent search, to discover any ruptured vessels, from which the blood might have flowed. Whence, then, does the fluid proceed? In one way alone can this question be satisfactorily answered: taking into consideration the fact just stated, that the vessels of the pericardium always retain their integrity, and the analogy afforded by the serous textures in other situations, under like circumstances, it may be concluded that the blood, in these cases, is the result simply of a process of exhalation, dependent upon an altered condition of the capillaries of the lining membrane. When the effusion occurs in cachectic persons, as it appears often to do in Russia and some other countries, it is not improbable that the blood itself is considerably modified in its properties, being preternaturally thin, black, and without any disposition to coagulate.

Cases occur, though very rarely, in which a considerable amount of *air* is accumulated in the cavity of the pericardium. Commonly conjoined with sero-purulent effusion, its presence may sometimes be detected, according to Laennec, by an unusually clear resonance at the lower part of the sternum, or by a sound of fluctuation produced by the beats of the heart, and by strong inspirations. Its chemical nature is not known. I have never seen an instance of this aëriform accumulation.

*Serous cysts* are occasionally found in the pericardiac capsule. Dr. Monro refers to a specimen of this kind, preserved in the museum of the University of Edinburgh, in which the morbid growth is nearly six inches long: the heart was of enormous size, and the patient had labored for several years under the usual symptoms of hypertrophy.

Finally, the pericardium is sometimes entirely absent. Such an anomaly is no doubt rare, and has been supposed to exist when it actually did not, from the deceptive appearance produced by the adhesion of this capsule to the outer surface of the heart.

Littre\* found the heart without any pericardium in a woman fifty-four years of age. The organ was dry, hard, rough, and had scarcely any fat. A case in which there was no trace whatever of this membrane is recorded by Dr. Baillie.† A similar example is mentioned by Mr. T. B. Curling.‡ The heart,

\* Hist. de l'Acad. Roy. des Sciences, 1712, p. 37.

† Medical and Chirurgical Transactions, vol. i., p. 91.

‡ Medico-Chir. Trans. of London, vol. xxii., p. 222. A highly interesting paper with valuable references.



which was rather large and flabby, occupied the natural position, but lay in immediate contact with the lung, without any appearance whatever of pericardium. The patient had reached his forty-sixth year. Walther, in his *Museum Anatomicum*, describes a preparation exhibiting this deficiency. The man was twenty years of age, and the organ lay naked in the same cavity with the left lung. In a case related by Breschet\* the heart was retained in its situation by two bridles, two inches long, which extended from the left side of its apex to the diaphragm, to which they were attached. Vestiges of the pericardium existed in the form of a shallow capsule on the left side of the mediastinum, close to the diaphragm, and of a cylindrical fibrous filament, crossing the base of the heart without adhering to it. Woolff† met with a case in which no trace of the pericardium could be discovered about the great vessels. The outer membrane of the heart was present, but it was unusually thin and lax in its texture.

In several of the above cases, the heart was invested by a serous membrane, continuous with the left pleura, which formed a perfectly reflected capsule.‡

The pericardium is sometimes partially transformed into bone; and, in one instance, observed by Dr. Barlow, of London, the ossification was complete. The foreign matter is probably deposited originally in the serous lamella, from whence it gradually extends to the fibrous membrane.

We often find upon the surface of the heart white, opaque *patches*, which exhibit considerable variety in respect to their form, size, situation, color, and consistence. They are evidently the effect of disease, and are met with at all periods of life; but much more frequently, according to my own observation, in adults and old persons than in children and infants. The latter, however, are by no means exempt from them. In what precise proportion this morbid alteration exists, is not settled. Mr. T. W. King,§ of London, supposes that, after the age of infancy, it occurs in "many more than half the bodies examined." Laennec, Baillie, and Hodgkin state that it is very common; an opinion in which my own experience fully coincides.

In their form these patches vary in different cases. In many, perhaps in most, they are irregularly ovoidal, in some they are circular, in some lozenge-shaped, and in some they are triangular, or almost square. In their dimensions I have rarely found them to exceed the diameter of a twenty-five cent piece, and very often they are not larger than a split pea. Laennec|| says, they are sometimes equal in size to the palm of the hand, but that they are generally much less, and often very small. Their most common situation is the anterior surface of the right ventricle, about its middle, but a little nearer to the apex than the base of the organ: they are also frequently seen on the anterior surface of the right auricle, and occasionally, though much more seldom, on the front of the great pulmonary artery. They are more or less opaque, and of a bluish-white, pale-straw, milky-white, or light greyish color. Their thickness rarely exceeds that of a healthy finger-nail; they have a smooth, even surface, with defined but not abrupt edges; and they vary in consistence, from that of a simple adventitious membrane to that of fibro-cartilage, cartilage, and even bone.

Corvisart supposes that this appearance is unconnected with inflammation; an opinion which is disproved both by analogy and observation. It is, in

\* *Répertoire Générale d'Anatomie*, t. i., p. 67.

† *Rust's Magazin für die gesammte Heilkunde*, vol. xxiii., p. 333.

‡ *Curling*, op. cit., p. 226.

§ *Guy's Hospital Reports*, April, 1838, p. 170.

|| *Diseases of the Chest*, p. 673.

fact, the effect of a partial pericarditis, attended with an exudation of plastic lymph, which is ultimately, by the constant attrition to which it is subjected by the action of the heart, converted into a species of adventitious membrane, similar to those which are so frequently observed in connection with the arachnoid, pleura, and peritonæum. In regard to the actual seat of the deposit, there is reason to believe that it is upon the free surface of the serous investment; a view which is confirmed by the circumstance that we are often able to dissect it off, so as to leave the subjacent structure entire. A specimen, strikingly corroborative of the truth of this statement, recently came under my observation in a man, twenty-eight years of age, dead of softening of the spleen. A patch, nearly an inch square, of a milky slate color, about a third of a line thick, and of a dense fibrous consistence, existed on the anterior surface of the right ventricle, near its centre; it was easily raised with the scalpel, had a perfectly smooth and polished surface, and seemed to be insensibly blended with the serous investment of the heart — its margins, where it united with the latter, being quite thin and bevelled off as it were. A similar spot, only much smaller, and more delicate, was situated on the posterior surface of the right ventricle, to which it was so firmly attached as to render it impossible to dissect it off. A great number of white, rounded, oblong, and angular bodies, not larger than a split-pea, existed on the surface of the right auricle, and were evidently of the same nature as those already described. The portion of the pericardium corresponding with the right half of the heart was covered with similar granulations; and projecting from it, at two points, were processes of organized plastic matter, the two largest of which were fully an inch in length. Now, all these phenomena clearly show that this man must, at no very distant period, have had pericarditis; and the only reason why the effused lymph did not every where exhibit the same appearance, was inereely because it was not every where exposed to the same degree of attrition. Thus, on the surface of the ventricle, both in front and behind, the patches were remarkably smooth, and attached with great firmness; while on the auricle and upper part of the pericardium, where the friction was much less, they had a rough, mammillated appearance.

Corvisart and Hodgkin are of opinion that the effusion occurs in the connecting cellular tissue; and Mr. T. W. King, the latest writer on the subject, thinks that it is usually seated in the substance of the serous membrane itself. Baillie and Semmering, from meeting so very constantly with these patches in their dissections, were led to suppose that they were entirely unconnected with disease.

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## SECTION II.

### OF THE HEART.

1. The heart, situated in the central part of the thoracic cavity, is placed in such a manner that its base looks obliquely upwards and backwards to the right side; the apex obliquely downwards and forwards to the left. Interposed between the great arterial and venous trunks, it has the same relations to the surrounding structures as the pericardium, by which it is enclosed. Anteriorly, it corresponds to the thymus gland, the breast-bone, and several of the costal cartilages; posteriorly, to the bronchial tubes, the œsophagus, and descending aorta: laterally, to the inner surface of the lungs and the

phrenic nerves. Inferiorly, it rests on the tendinous centre of the diaphragm, which forms the floor of the chest, nearly on a level with the fifth rib, and thus separates it from the abdominal viscera. It is important to remember that, excepting in a few rare instances, the pericardium is not entirely covered by the lungs, but that a portion of it remains in immediate contact with the walls of the thorax. This portion, which is of a lozenge shape, corresponds to the anterior surface of the right ventricle, and is seldom more than an inch and a half in extent.

In the normal state, the apex of the heart beats against the fifth costal cartilage, or against the interval between the fifth and sixth, near their junction with the ribs. The right ventricle is situated in front of the left, which is in great measure concealed by it. The auricles, forming the base of the heart, mount as high up as the interval between the third and fourth costal cartilages, and are placed almost entirely under cover of the sternum. The valves of the pulmonary artery are situated a little to the left of the median line of the breast-bone, on a level with the inferior border of the third rib : those of the aorta are directly behind, and consequently concealed by them.

The organ, instead of being situated obliquely, is sometimes placed, like the heart of a quadruped, in a line with the sternum ; and, occasionally, though rarely, it is found to protrude externally, through an opening in the chest. Cases have been observed where it lay in the epigastric region, on the outside of the ribs, and in the substance of the liver. Baudelocque examined the body of an infant, in which there were two distinct hearts, one of which occupied the abdomen, the other the thorax. Instances are also recorded in which the organ was situated in the right side of the chest. These cases are usually associated with transposition of the abdominal viscera.

The situation of the heart is also influenced by diseased states of the lungs, aneurismal enlargements of the aorta, and by collections of water or purulent matter within the pleura or abdomen. In ascites, the organ is sometimes remarkably tilted up ; and in hydro-thorax, it is frequently thrown entirely out of its natural position, so that the impulsion of its apex can be felt on the right side instead of on the left.

In its shape, the heart is somewhat conical, the base being above, and the apex, which is formed entirely at the expense of the left ventricle, below. The division between the four chambers of which it consists is indicated externally by two grooves, one running transversely, the other nearly vertically. The color of the heart, in a healthy adult individual, is of a florid red ; but it assumes a paler aspect as we advance in life ; and, in certain morbid states of the system, especially in dropsical affections, it is frequently quite blanched. It is a remarkable fact that the internal fibres are generally of a much deeper red than the exterior. With regard to its consistence, the organ is sufficiently firm to resist the pressure of the finger. After death, the auricles, from the flaccidity of their walls, are always in a collapsed state ; and the same is the case in respect to the right ventricle. The parietes of the left ventricle, on the contrary, are so thick as to prevent the obliteration of the corresponding cavity.

In the new-born infant, the position of the heart is nearly vertical, so that it lies more along the median line, as in some of the inferior animals. Its color is also of a brighter red, its muscular fibres are more distinct, and the walls of the ventricles are proportionally stouter, as well as more nearly alike in regard to their thickness.

The weight and volume of the heart vary much in different individuals, as well as at the different periods of life. Numerous attempts have been made to fix upon some standard of comparison, by which we might judge, with some



degree of certainty, of its dimensions, but with so little success that the results that have been furnished can be regarded only as affording approximate evidence. Thus, Lobstein estimates its weight at nine or ten ounces; Cruveilhier at six or seven; and Bouillaud at eight or nine. Dr. Clendenning\* examined nearly four hundred hearts in persons of both sexes, and at all ages after puberty. The result was about nine ounces avoirdupois for the male, and seven ounces and a half for the female; or, as it respects the entire body, at the rate of about 1 to 160 for the former, and 1 to 150 for the latter. Dr. John Reid, in eighty-nine cases, found the average weight of the male heart to be eleven ounces and one drachm, and of the female heart, in fifty-three cases, nine ounces and half a drachm. In ten examinations by myself, the medium weight was eight ounces and a half; the minimum seven, and the maximum ten and a half. Laennec merely observes that the heart ought to be about the size of the fist of the subject; a means of comparison, which, although somewhat vague, will usually be found, according to my own experience, to be very near the truth.

The average length of the ventricles, including the apex of the organ, is four inches; of the auricles, one inch and three-quarters. The mean circumference, measured around the auriculo-ventricular groove, is nine inches and a half; the breadth four inches. The thickness of the ventricles varies in different parts of their extent. Thus, the thickness of the right is scarcely two lines at the middle, whilst it is nearly two and a half at the base, and about one and a quarter at the apex. So also of the left ventricle; whilst it is seven lines in thickness at the centre, it is only six at the base, and four and a half at the apex. Of the right auricle, the mean thickness is one line; of the left, one line and a half. The thickness of the inter-ventricular septum also varies in different parts of its extent, being at its maximum at the middle, where it is six lines and a half, and at its minimum at the apex, where it is nearly the sixth of an inch less. The mean thickness of the inter-auricular partition is one line and a half.†

The above measurements are founded upon a careful examination of twelve hearts taken from male and female subjects, between twenty-five and forty, and which were, in every respect, so far at least as I could determine, perfectly sound. They differ in some particulars from those of Bouillaud and Lobstein, which is not surprising when it is remembered that the weight and dimensions of the organ in question, whether considered as a whole or in reference to its several parts, are remarkably influenced by sex, stature, age, and individual peculiarities; so that upon this point it is extremely probable that the results of any two writers will never perfectly coincide. It would appear from the interesting researches of Dr. Bizot,‡ of Geneva, that the dimensions of the heart are in direct proportion to the breadth of the shoulders, and that the organ is always bigger, not relatively, but absolutely, in persons of middle stature or under, than in those who are distinguished for their tallness.

\* Dunglison's Human Physiology, vol. ii., p. 72. Phila. 1844.

† Professor Lobstein, of Strasburgh, attributes the following mean dimensions to the healthy adult heart: length, from the base to the apex, five inches and a half; breadth, at the base, three inches; thickness of the walls of the right ventricle, at the upper part, two lines and a quarter, at the lower, half a line; of the left, seven lines superiorly, and four inferiorly; thickness of the right auricle, one line, and of the left, half a line. (*Traité d'Anatomie Pathologique*, t. ii.)

M. Bouillaud found the mean circumference of the organ, measured around the base of the ventricles, to be eight inches and three-quarters; the mean length, from the root of the aorta to the apex, nearly three inches and two-thirds; and the same, as the mean breadth, measured at the base. The average thickness of the right ventricle, stated in round terms, is, according to the same authority, two lines and a half, and that of the left, seven lines; of the right auricle, one line, and that of the left, one line and a half. (*Traité Clinique des Maladies du Cœur*, t. i., p. 52.)

‡ *Mem. de la Société Med. d'Observation de Paris*. t. i., p. 276.

The mean circumference of the mouth of the aorta, measured in the same subjects, was two inches and three-quarters; of the pulmonary artery, three inches and a sixth. Of the left auriculo-ventricular orifice, the average circumference was four inches; of the right, four inches and a half.

By placing the ear over the præcordial region of a healthy individual, two distinct sounds may be heard, followed by a period of rest. The first, supposing the pulse to be sixty in a minute, lasts about half a second, the other about a fourth, and the interval of repose the remaining quarter of the second. The first sound, which is dull and prolonged, coincides with the contraction of the ventricles; the other, which is sharp and clacking, with their dilatation.

Concerning the causes of these sounds, there is still considerable difference of opinion, notwithstanding the numerous attempts that have been made to investigate them. From the experiments of Dr. Hope, an account of which is to be found in the recent edition of his excellent treatise on the Diseases of the Heart and Great Vessels, it would appear that the first sound is of a compound character, being produced partly by the shutting of the auriculo-ventricular valves, partly by the vibratory action of the muscular and tendinous fibres, and partly by the collision of the blood in its passage through the lower cardiac chambers. In regard to the second sound, the most probable conclusion is, that it depends upon the flapping of the sigmoid valves at the mouth of the aorta and pulmonary artery. At all events, it has been fully ascertained that it is stopped, and succeeded by a peculiar hissing noise, on transfixing one or more of these folds with a curved needle, and thus confining them against the walls of the vessels, so as to arrest their action. Similar efforts follow, though in a less striking degree, the compression of the aorta and pulmonary artery, whereby the column of blood is prevented from falling back against the sigmoid valves.

The cardiac sounds vary greatly in intensity in different individuals. Ordinarily they are not audible, except at the præcordial region, if the ear be more than an inch and a half from the chest. The absence of adipous matter, the thinness of the ventricles, and the energetic contraction of the muscular fibres, together with the force with which the valves are thrown into action, are so many causes the direct tendency of which is to augment the loudness of the sounds. It is worthy of remark, moreover, that the sounds are transmitted in a much more intense form through hepatized, tubercular, or compressed portions of lung than through such as are healthy.

It is extremely difficult, especially for one who is unpractised, to distinguish between the normal sounds of the two sides of the heart. Nor is it possible to define their exact limits, except in a general manner, which is, that they are audible in almost every part of the chest, but much more distinctly so at the præcordial region, and at the left side of the sternum, near its junction with the third costal cartilage, than in any other situation.

The capacity of the opposite reservoirs of the heart does not seem to be precisely alike, although, if we take into consideration the fact that the same amount of blood flows through both, it might reasonably be inferred that the reverse was the case. The two auricles are evidently larger than the ventricles, especially the right, the size of which is generally about one-fifth greater than that of the left. This disproportion in the capacity of the auricles is by no means imaginary, as some anatomists have asserted; nor can it, properly speaking, be dependent, as has been alleged by others, on the particular kind of death; for, although the walls of the left chamber are more uniformly muscular, as well as a little thicker, than those of the right, yet if these cavities be carefully distended with wax, the right will always be found to be considerably larger than the left.

This fact, indeed, is so familiar to those who are in the habit of making preparations of this organ, that it would be idle to dwell upon it.

With respect to the ventricles, the capacity of the right has usually been supposed to exceed that of the left, an opinion which appears to be almost coeval with the earliest records of anatomy. Santorini, whose experiments on this subject are worthy of an attentive perusal, however, arrived at an opposite conclusion; and the same is the case with the observations which have since been made by Lower, Weip, Moor, Lieutaud, Sabatier, and other inquirers. Haller and Meckel assert that the difference, whenever there is any, is always attributable to the species of death, the results of their researches leading them to believe that either the one or the other of these reservoirs may be rendered more capacious, just according as the blood is arrested, during the last struggles of life, in the lungs or in the aorta. Opposed, again, to this conclusion are the observations of Seiler and Legallois, who, by distending the heart with mercury, invariably found that the right ventricle was larger than the left, no matter on which side of the organ the blood accumulated during death. This statement is likewise borne out by the examinations of Bouillaud, and is in perfect accordance with the results of my own researches. Legallois endeavors to account, very correctly, as I think, for this difference of capacity, by the well-known fact that the parietes of the left ventricle are much stronger and more muscular than those of the right, in consequence of which they are much less liable to become dilated; the corresponding cavity thus presenting always the same size, whereas the other, from the same cause, is constantly subject to enlargement. The absolute capacity of these reservoirs has not been very accurately determined; but it will be sufficiently near the truth to state that, in their normal condition, they are capable of holding a hen's egg. The auricles, as above stated, are obviously a little larger.

The outer surface of the viscus is covered by a reflection of the serous lamella of the pericardium, from which it obtains its smooth and polished appearance; whilst its several chambers are lined by a membrane of a similar nature, which is continuous on the one hand with that of the hollow veins and of the pulmonary artery, and on the other with that of the aorta and of the pulmonary veins. In the healthy state, this membrane is perfectly white and pellucid: it is scarcely thicker than the arachnoid tunic of the brain, and it adheres so firmly to the muscular substance that it can be detached only in very small shreds. Like the inner coat of the vessels, it is readily discolored by imbibition; and, in certain morbid affections, it is rendered rough, opaque, and uneven, acquiring the consistence of the fibrous layer of the pericardium. In its structure, this serous lining differs considerably in the two sides of the heart, that of the right half being very extensible, resisting, and but little liable to ossification, whilst that of the left half is almost inextensible, remarkably brittle, and extremely prone to bony deposits. This membrane, it may now be observed, is named the *endocardium*, and plays a very important character in the diseases of the heart. No vessels or nerves have been traced into its substance.

The endocardium is arranged in certain portions of its extent in the form of folds, the principal of which are situated at the mouth of the aorta and pulmonary artery, the orifice of the inferior hollow vein, and the auriculo-ventricular apertures. In their shape, they are nearly all semilunar; and they are composed each of two distinct lamellæ, connected together by short, dense cellular substance. In addition to this, there is in the duplicature of the aortic and pulmonic valves, at the centre of their free margin, a small, firm tubercle, called the corpuscle of Arantius, after a professor of Bologna, who first described it.



The precise nature of this little body is not determined, but it appears probable that it is of a fibro-cartilaginous structure. The auriculo-ventricular valves, or, as they are more commonly termed, the mitral and tricuspid, are united on the one hand to the slender tendons of the fleshy pillars, and on the other to the contour of the corresponding orifices by a whitish, fibrous zone, which is particularly distinct on the side of the auricles. Thus the heart would seem to be composed of five entirely different anatomical elements, the muscular, the serous, the fibrous, the fibro-cartilaginous, and the tendinous.

The heart contains scarcely any cellular substance, being composed essentially of muscular fibres. In many cases, especially in fat persons, there is a considerable quantity of adipous matter, which is generally most abundant along the course of the coronary arteries, at the origin of the great vessels, and on the surface of the right ventricle. In a number of instances I have seen the whole organ incrustated with this substance, forming a smooth yellow lamella, from the third of a line to a line and a half in thickness, and yet the muscular fibres were perfectly sound.

The proper cardiac substance is much more firm and dense, as well as of a deeper red, than that of the voluntary muscles, and is composed of numerous fibres, lying in close contact with each other, and running, for the most part, in an irregularly spiral direction from the base to the apex of the organ. In the auricles, the walls of which are much thinner, as before stated, than those of the ventricles, they are arranged into two planes, one of which is external, the other internal. In the venous portion of the right auricular cavity, the fibres exhibit a smooth, uniform appearance, whilst in the proper ear-like appendage they are disposed in small parallel bundles, constituting the so-called pectineal muscles: here numerous intervals are left between them, at which the two serous membranes of the heart are almost in immediate contact. In the left auricle, the two muscular strata are somewhat thicker, and also more uniform in their mode of arrangement: the fibres may be said to begin at the entrance of the pulmonary veins, and to take nearly all a transverse course, with the exception of the more deeply seated, which cross each other in almost every conceivable direction. The inter-auricular septum is likewise of a muscular nature, and the layer of which it is composed is considerably thicker and stronger than those forming the walls of the auricles.

The fleshy fibres of the ventricles are interwoven with each other at right angles, and they are all arranged — at least if we may credit the assertion of Wolff, Gerdy, and others, who have particularly investigated this subject — in the form of loops, the convexities of which look towards the apex of the organ. In the left ventricle the fibres are disposed in six layers, and in the right only in three, which accounts for the comparative thickness of their walls. The superficial strata run obliquely downwards, backwards, and towards the left side; the middle take precisely the opposite direction; and the deep-seated ones, which form the fleshy columns of the heart, are for the most part longitudinal. After all, it must be confessed that it is extremely difficult to determine the exact arrangement of these fibres; let us adopt what method we may; and instead, therefore, of saying that they follow one particular course more than another, it may be boldly affirmed that they begin at all points, and extend in all directions, forming thus a network which it is utterly impossible for any ingenuity to unravel.

The heart is supplied with blood by the two coronary arteries, the branches of which are distributed through every part of its substance: they take their origin just behind the sigmoid valves, and, as might be supposed, pursue a

most tortuous course. The coronary vein is very large, and embogues into the right auricle. The lymphatics, which are quite numerous, follow, for the most part, the direction of the blood-vessels. The nerves are derived principally from the cervical ganglion of the trisplanchnic; but a few filaments are also furnished by the pneumo-gastric; which accounts for the sympathetic relations which subsist between the lungs and the central organ of the circulation. Scarpa and Munninks have fully demonstrated, that the branches of these nerves are extensively distributed to the fleshy fibres of the heart, and not merely, as was contended by Behrends and some others, to the cardiac vessels.

II. The heart, like other organs, is liable to *malformations*. These, though not frequent, are so various as to render it extremely difficult to classify them according to philosophical principles. Any generalization, indeed, that may be offered must necessarily, in the present state of the science, be imperfect and susceptible of future improvement. The following, without pretending to any thing more than ordinary accuracy, will be found to embrace an account of the more interesting varieties hitherto noticed. Before we proceed to indicate this arrangement, it should be stated that the different congenital deficiencies of which we shall speak, may be conveniently viewed in reference, first, to the parietes of the organ; secondly, in respect to its internal septa; thirdly, in relation to its valves, and, fourthly, in regard to the origin and termination of the great vessels.

(1.) 1. The heart consists only of one auricle and one ventricle. This malformation is rare. Cases, however, are related by Kreisig, Burns, Billard, Breschet, and other authors. The organ gives origin to a single vascular trunk, which presently divides into the aorta and pulmonary artery. The type of this imperfection is to be found in fishes, in which the single heart and artery, with its branchial arches, are permanent parts. This malformation, it need scarcely be observed, is always hostile to the prolongation of life. The infant generally dies within the first twelve days.

2. Both auricles are wanting; or there are two ventricles, with one auricle; or, finally, two auricles, with one ventricle. These cases are likewise extremely rare; in a few instances the patient attained the age of manhood.

3. The auricles have a sort of supernumerary appendage. Of this species of malformation De Haen and Billard have each recorded an instance.

4. The apex of the heart is bifurcated, or there is a deep groove marking the junction of the ventricles. The former of these appearances naturally exists in the human embryo, and constitutes the type of what is found in several species of mammalia, as the dugong and manatee.

(II.) The second series comprehends the malformations of the internal partitions, of which the most frequent and important are those of the inter-auricular septum. The aperture which naturally exists at this part is generally closed within the first few days after the establishment of the respiratory function, by a fold of serous membrane situated at the left side of the heart. This valve is sometimes defective, perforated, or entirely absent. More frequently, however, there is an arrest in the development of the muscular substance, eventuating in the formation of an imperfect partition. The septum thus produced is seldom more than three lines in diameter, but occasionally the deficiency is complete. This malformation frequently coexists with patency of the arterial duct. Although the individuals usually die within the first six months, yet cases are mentioned where life was protracted to the twentieth, thirtieth, fortieth, and even fiftieth year.

A congenital opening between the two ventricles is by no means common;

at any rate very few such cases have been recorded by writers. The form of this aperture is generally rounded, with smooth, polished margins; and, in the majority of instances, it is situated at the superior part of the septum, not far from the origin of the great vessels. With this vice there is frequently patescence of the arterial duct and oval foramen, with contraction of the pulmonary artery. The essence of this imperfection exists in the heart of the alligator, in which the ventricles naturally communicate with each other during life. Infants thus affected, usually die soon after birth. Dr. Pulteney relates the case of a patient who reached his fourteenth year.

The symptoms which indicate the existence of these malformations are such as might be expected to arise from the admixture of venous and arterial blood in the chambers of the heart. The individual is always in ill health, the respiration is disturbed, the circulation disordered, and the temperature of the whole body diminished. With these phenomena, which are present to a greater or less extent, according to the size of the opening, there is a peculiar bluish discoloration of the skin, which is most conspicuous in the face, lips, eyelids, nose, and ends of the fingers, and which may be regarded as pathognomonic.

(iii.) The valves rarely exhibit congenital imperfections. Sometimes they are deficient in numbers, but more frequently they are too short, reticulated, or perforated, so as to serve as incomplete barriers to the regurgitating fluid. The sigmoid, mitral, and tricuspid valves have all been found stretched flat across their respective orifices, with one or more apertures in their substance. The Eustachian valve is more frequently deficient than any other.

(iv.) The fourth class of malformations relates to the origin and termination of the great vessels, which often exist without any accompanying imperfections of the heart. Of these, several varieties may be enumerated.

1. The aorta arises from both ventricles. This state is commonly accompanied with patescence of the oval foramen and arterial duct, the latter of which occasionally ends in a cul-de-sac in the substance of the heart. The pulmonary artery is either contracted, obliterated, or entirely absent. Death ensues at various periods, from the first day to the fourteenth year. The symptoms are such as denote a mixture of venous and arterial blood, namely, lividity of the prolabia, palpitations, and paroxysms of suffocation.

2. The pulmonary artery springs from both ventricles. This is also a very rare variety of malformation. The oval foramen remains open; and the vessel sends off the descending aorta, the ascending arising in the ordinary way.

3. The aorta arises from the right ventricle, and the pulmonary artery from the left. In this transposition, the veins generally retain their normal disposition. Nor do the oval foramen and arterial duct always remain open.

4. Both vessels originate from the same ventricle. This is extremely rare. Several well-authenticated cases, however, are on record. The internal septa of the heart are usually imperfect in this variety of malformation.

5. The arterial duct opens directly into the right ventricle, the aorta and pulmonary artery exhibiting nothing unusual in their size or mode of arrangement. This irregularity has been observed only three or four times.

In regard to the venous trunks, the deviations from the normal standard are not less singular. Thus, the right auricle has been known to receive the pulmonary veins, and the left the superior or inferior cava, or both. Meckel relates an instance where the coronary vein opened into the left ventricle; and Breschet records one, where the hepatic veins emptied directly into the right auricle. The latter cavity also sometimes receives the azygous vein. Le Cat narrates a case in which this vessel divided, near the heart, into two branches, of which one terminated in the right, the other in the left auricle.



*Acardia*, or total absence of the heart, is extremely rare, and never occurs without being associated with other vices of conformation, of which the most common is deficiency of the brain. Such a state, whether simple or complicated, is of course inconsistent with the continuance of life. A double heart has occasionally been observed, but in no instance, perhaps, without a monstrous condition of the majority of the other organs.

III. The lesions of the muscular structure of the heart may be arranged under the heads of inflammation, suppuration, ulceration, gangrene, softening, induration; cartilaginous, osseous, and fatty transformations; scirrhous, encephaloid, melanosis, and tubercle; hypertrophy, atrophy, dilatation, and rupture.

1. *Acute carditis* is an extremely rare disease, especially that variety of it which invades the whole organ. In the majority of instances, it is conjoined with inflammation of the investing capsule; in others, however, it exists as an independent affection, and runs its course without any particular complication. Of general carditis, very few well-authenticated cases are upon record. The disease seldom assumes that acute type which generates pus; in which respect it offers a striking analogy with inflammation of the voluntary muscles. Of this mode of termination, however, several examples have been related by the British and French pathologists. In the third volume of "the London Medical Gazette," Dr. Latham has given the particulars of a case of this kind, in a boy twelve years of age. "The whole heart," says he, "was deeply tinged with dark-colored blood, and its substance softened; and here and there, upon the section of both ventricles, innumerable small points of pus oozed from among the muscular fibres. This was the result of a most rapid and acute inflammation, in which death took place after an illness of only two days." Meckel saw a case, in a man fifty years old, in which the muscular substance of the heart was considerably infiltrated with purulent matter; the fibres were of a bright red color, rough, unequal, and as clean as if they had been dissected from their cellular tissue.

Much more frequently the disease is partial, or limited to particular parts of the organ. Here, as in the other variety, the inflamed structure is always unnaturally red, and crowded with small crimson points, of an arborescent, stellated, or punctuated configuration. Occasionally, as when the irritation is very severe, we meet with spots of extravasated blood, of a bright red, violet, or purple tint, which impart to the surface of the organ a singularly speckled aspect. Inflammation of the muscular substance of the heart is rarely, if ever, attended with tumefaction. Why this should be the case will be at once perceived when we reflect upon the intimate and almost inseparable connection of the fleshy fibres; for, of all the muscles in the body, the heart is the one which has the least amount of cellular matter. Hence, serous infiltration, which is so common in some other structures of the system, can have no place in the organ now under consideration. When the inflammation is seated superficially, the affected part is often covered with globules, shreds, or patches of lymph, poured out by the visceral portion of the serous membrane of the pericardium, from a propagation of the disease. Its consistence is often much diminished; and not unfrequently the muscular fibres are bathed in imperfectly elaborated pus. The diagnostic signs of carditis, if there be any, are still involved in obscurity. Dr. Bouillaud, the most recent and elaborate writer on the diseases of the heart, positively asserts that he has never seen an instance which was not complicated with pericarditis or endocarditis; and he frankly acknowledges that, in the three cases which came under his notice, the signs of the two latter affections were all that attracted his attention. Nor have any other authors, so far as I am acquainted with their works, been more successful.

When the disease passes into *suppuration*, the pus may either be diffused through the muscular texture, or be collected into an abscess. Of this, numerous examples are related by the older anatomists, and not a few by those of a more recent date. Corvisart found an abscess of more than an inch in length, near the apex of the right ventricle of the heart of a young man of nineteen. Laennec met with two instances of cardiac suppuration, in one of which the pus was deposited amongst the fleshy columns of the left ventricle; in the other, it formed an abscess, about the size of a bean, in its substance.

A very instructive case of acute carditis attended with suppuration was published a short time ago by Mr. Salter, of England.\* The patient, a man fifty years old, tall and well formed, was a glover by trade, and was sick about a week. The attack was characterized by a dull, heavy pain in the cardiac region, great difficulty of breathing, indescribable anxiety, constant restlessness, inability to lie down, and a small, feeble, and almost imperceptible pulse. The heart was somewhat larger than natural; its substance was of moderate firmness; large coagula were found in all the cavities; and the wall of the left ventricle, which was of a lightish yellow color, contained a number of small abscesses, varying from the size of a pin-head to that of a small pea. Pus was also diffused among the muscular fibres of this part of the organ, and could be readily scraped from the cut surfaces of the various sections. The lining membrane was free from disease; but the pericardium was unusually vascular, and that part of it which was attached to the diaphragm exhibited numerous ecchymosed spots and blotches, resembling those observed on the skin in purpura hemorrhagica. No serous, bloody, or purulent fluid existed in its cavity. Some effusion was noticed in the right chest, and nearly the whole of the left lung was in a state of considerable engorgement.

Collections of pus are occasionally found within the heart. Of this a case has been already given from Laennec, and another has recently been reported by Dr. Mareshal, a French physician. It occurred in a young girl ten years of age. The heart, both ventricles of which were very much dilated, contained three distinct abscesses, each about the size of a small nut. Of these, one was seated in the left ventricle, near the centre of the inter-ventricular partition, the other two in the right. They were of a white greyish color externally, and filled with a dirty, yellowish looking fluid, of the thickness and consistence of cream. Cases of a similar character are narrated by Mr. Wardrop,† and various other authors on morbid anatomy. The muscular substance around such collections is generally red and softened.

Circumscribed carditis is sometimes attended with *ulceration*. The lesion is more frequently found on the internal than on the external surface of the organ, and commonly supervenes upon inflammation seated originally in the lining or investing membrane. The external ulcer has been described by some of the older pathological anatomists. I have never seen a case of the kind, but in one, the particulars of which have been communicated to me by Professor Harrison, of Cincinnati, the whole outer surface of the heart was abraded by ulceration, the appearance being very similar to that species of ulceration denominated the cutaneous by Mr. John Hunter. The pericardium, much indurated and thickened, contained several ounces of purulent matter. In other respects, both the heart and its capsule were sound. The right lung was completely hepatized, the left partially. In the abdomen was contained about half a gallon of sero-purulent fluid; the liver was somewhat enlarged,

\* Medico-Chir. Transactions of London, vol. xxii., p. 72.

† See his edition of Baillie's Morbid Anatomy.

unusually vascular, and adherent in different parts. All the other organs were in a normal condition. The subject of this case, so extremely interesting from the large extent of the ulceration, was a boatman on the Ohio river, thirty-five years old, who was admitted into the Louisville Hospital in April, 1825. He died in about a fortnight thereafter, having suffered incessantly under dyspnœa, and dry, convulsive cough, with inability of lying on either side, dropsy of the abdomen, and œdema of the extremities.

These ulcerations sometimes extend deep into the substance of the heart, leaving merely a thin stratum of muscular fibres. The cardiac texture around is generally very hard, pale, and so friable as to break down under the slightest pressure of the finger. The matter with which these ulcers are bathed, is of a bland, homogeneous nature, like laudable pus in other situations: in a few instances, it is mixed with bloody serosity.

2. Is it possible for the muscular structure of the heart ever to become *gangrenous*? Many writers suppose that it is not, alleging, as a reason, that, as this organ is so essential to life, this termination of inflammation is always anticipated by death. Others, however, not only admit the possibility of it, but cite numerous cases in confirmation of their opinion. Leaving out of the question the more doubtful testimony of Bonetus, Morgagni, Lieutaud, and other authors of the seventeenth and eighteenth centuries, the results of the observations of modern writers, are, I think, abundantly sufficient to settle the point. Portal, Goulay, and Kennedy relate each a well-marked example of this disease. The gangrenous substance, says Portal, is of a dark color, relaxed, softened, infiltrated with ichorous serosity, and quite offensive to the smell. Not unfrequently it is of a livid, brownish, or greenish hue, and emits an odor like that of a piece of flesh in a state of partial decomposition, which constitutes the essential characteristic of this lesion. In most cases, the mortification occurs in superficial, dark-colored patches, not more than a line or two in depth; but more rarely it pervades the entire organ. The most interesting case of this kind, perhaps, on record, is that by Dr. Kennedy, of Glasgow, an account of which was published in the London Medical Repository for April, 1824. The cardiac tissue, which exhaled quite a putrid odor, was throughout remarkably flaccid, of a black color, like venous blood, and easily perforated with the finger. The left ventricle, particularly, was very livid, and scarcely of the consistence of the cerebral substance. No blood exuded from any of the ruptured vessels of the heart, and all the chambers were perfectly empty. The inner surface of the pericardium was of a dark red color, and its cavity contained about four ounces of a fetid, yellowish fluid, of a serous nature.

It appears from the dissection made eight hours after death, that there existed a remarkable tendency to gangrene, not merely in the heart, but in various other organs and textures, especially the omentum, small intestines, uterus, and skin of the upper extremities. The subject of this extraordinary case was a woman somewhat past the prime of life. The symptoms were of the most violent character. Long before death the pulse had disappeared altogether from the wrists. There were stinging pains, with a sense of burning, in the region of the chest; difficulty of breathing; palpitation of the heart; frequent disposition to syncope; tumefaction of the limbs, and almost complete immobility of the joints. Towards the last, broad, livid spots appeared on different parts of the surface, with here and there a large and sphacelated wheal, and the patient finally expired in a state of deep coma.

In a case of partial gangrene, narrated by M. Gaulay,\* a French physician,

\* Journal de Med. Chir. et Pharm. Janvier, 1807.



two blackish-looking streaks, more than a line in depth, were observed on the anterior surface of the heart, extending from its base to its summit. The whole organ was extremely flaccid, soft, lacerable, and of an unpleasant odor; it was of the usual volume, and had contracted extensive adhesions with the pericardium, in the interior of which was a small quantity of serosity. During the three days preceding dissolution, the patient, a female, fifty years of age, labored under the most frightful dyspnoea; the pulse was very small, unequal, and intermittent; and, at intervals, the heart beat with the utmost violence, though, at times, its movements were scarcely perceptible. The liver, pancreas, and spleen were considerably enlarged, and in a state of scirrhus induration.

Such is a brief outline of these two interesting cases of cardiac gangrene. That they are true examples of this rare disease cannot be doubted; such, at all events, must be our conclusion, both from the phenomena exhibited during life, and from the appearances revealed on dissection.

3. The heart, like other organs, is liable to *softening*, which may be either partial or general, though the latter must be considered as extremely rare. It may coexist with various other lesions, such as hypertrophy of the walls of the organ, or dilatation of its cavities, or it may take place as an independent affection. Occasionally, the softening is limited to the outer surface of the heart, the inner surface, or to the fleshy columns; and not unfrequently it is found in small isolated points, running insensibly into the healthy texture. No unnatural odor attends this lesion, in which respect it differs remarkably and characteristically from gangrene.

The cardiac substance, in a state of softening, is extremely flaccid, tears with great facility, and is of a deep red color. The finger can be pushed through it in every direction, and when the ventricles are opened, they often collapse to so great a degree as to lose entirely their natural figure. This, however, is by no means a uniform, or even, perhaps, a general occurrence. Much oftener, indeed, the softened organ accurately retains its natural form. The color of the cardiac tissue in this affection is variable. Most commonly, perhaps, as was before stated, it is of a deep red; but, occasionally, it is claret, marone, red-brown, violet, or purple. In other cases, again, though very rarely, it is of a faint greyish hue, cineritious, pale yellow, or almost white, as if the organ had been macerated for some days in water. These different shades of color appear to be so many modifications dependent upon corresponding grades of inflammatory irritation.

Softening of the heart often occurs in connection with tubercles of the lungs, chronic pleuritis, and adynamic fevers. In one instance, I found it in an old man who died of apoplexy, after an illness of about five days. The lesion is not peculiar to the human subject. I have met with it several times in the horse. In a remarkable case, occurring in a young colt that died of pleuropneumonitis, accompanied with an enormous accumulation of fetid water in the chest, the cardiac substance was of a red brown color, and so soft that I could easily push the handle of the scalpel through both ventricles in every direction.

Doubts are still entertained by many writers whether softening of the heart ought to be uniformly ascribed to inflammatory irritation, or to some disorganizing cause of another character. Laennec,\* who first directed the attention of the profession to this disease, considers it as a peculiar affection, produced, as he thinks, by some aberration of nutrition, by which the solid elements of the muscular tissue are diminished in proportion as its fluid elements are augmented.

\* Treatise on Diseases of the Chest, by Forbes, p. 623.

This singular notion, which merely expresses the vague sentiments of its author, has been successfully controverted by Bouillaud. By him, softening of this organ, under whatsoever form it appears, is attributed to the effects of inflammation, either of an acute or chronic character; and with this opinion my own belief entirely agrees. Many symptoms have been pointed out as attending this disease; as yet, however, none have been enumerated that can be relied upon as pathognomonic.

4. Leaving the subject of softening of the heart, we come, in the next place, to that of *induration*, a state which, like the preceding, is, in all probability, induced by inflammation, though generally of a much more chronic character. The affection seldom occupies more than a part of the organ, commonly one of the ventricles, which is at the same time in a state of hypertrophy. Sometimes it is confined to its outer or inner surface, to the fleshy columns, or to the inter-ventricular septum; and not unfrequently it is blended with softening. In a case detailed by Bertin, there was induration of the left, with mollescence of the right ventricle; and, in a second, some of the fleshy columns were hard, and others soft. Universal induration is perhaps never met with: such an occurrence, in fact, would hardly be compatible with the exercise of the functions of the heart.

The degree of induration is subject to considerable variety, running through numerous stages, from the fibrous to the cartilaginous, and even the osseous. In some instances it appears in the form of incrustations, and seems as if it had commenced, in the first instance, in the scrous covering of the organ. The muscular substance is not always heightened in color; sometimes, indeed, it is even unnaturally pale. When incised, it is found to be so firm as to grate under the knife. Corvisart states, that on cutting through an indurated heart, he has occasionally heard a peculiar creaking sound, like that emitted by new sole-leather; but this has never been perceived by Laennec, Bertin, Hope, Andral, or myself, and may therefore be regarded as very rare. The organ, if placed on a table, generally retains its rounded form, and if struck with the scalpel, sometimes sounds like a dice-box or hollow horn.

The diagnosis of induration of the heart, like that of mollescence, is involved in obscurity, it being quite impossible, in the present state of our knowledge, to distinguish it from hypertrophy, with which it is so often associated. When these affections coexist, the impulse of the heart is frequently augmented to such a degree that it can be seen and heard at some distance from the patient; if, on the other hand, the induration is uncomplicated, very extensive, or of long standing, the strength of the organ is apt to fail, and, as a consequence, the pulse at the wrist becomes sometimes nearly imperceptible. How far the assertion of Laennec, that the firmest heart always imparts the strongest impulse, is correct, I will not pretend to decide; I can only say, that so far as I know, his opinion has not been verified by other observers.

5. The *cartilaginous* and osseous transformations of the muscular structure of the heart may next be noticed. Both these lesions are extremely rare; and I have not been so fortunate as to meet with them. Corvisart has seen the apex of the organ, in its entire thickness, and the fleshy columns of the left ventricle, converted into cartilage. Haller, Albertini, Bertin, and others, have observed partial ossifications; and the late Mr. Allan Burns, of Glasgow, found the ventricles of the heart of an old woman of sixty so completely changed that they resembled the bones of the cranium. This case, the most remarkable perhaps on record, was attended with violent dyspnoea, great præcordial anxiety, and lividity of the countenance. The patient was unable to lie in any other than a semi-erect position; and, for a few days before her death, the pulse,

although previously regular, became extremely feeble and intermittent. On dissection, the pericardium was found of an opaque, dusky color, excessively loaded with fat, closely adherent to the substance of the heart, and studded with ragged, projecting spicules of bone, which gave it a very rough and irregular aspect. Both ventricles were completely ossified, excepting about a cubic inch at the apex, the new tissue forming a broad, solid belt, as firm as the cranium. The auricles were sound, only a little thicker than usual, and so also were the great vessels.

A case nearly as remarkable as the preceding is to be found in the "Journal de Médecine" of Paris, for January, 1816, where it was reported by Dr. Renaudin, a French physician. It occurred in a man thirty-three years of age, who had been afflicted for a long time with embarrassment of breathing and cardiac palpitation. The left ventricle was converted into a petrification, which, in some parts, had a sandy aspect, in others, resembled a saline crystal. The fleshy columns, also ossified, were much increased in their dimensions, and looked like so many stalactites. Professor Monro,\* of Edinburgh, states, that he has in his possession a specimen, in which the whole heart, with the exception of the left auricle, is converted into a mass of bone.

6. *Scirrhus* and *encephaloid* have been found in the substance of the heart, but their occurrence is extremely rare. The latter of these lesions generally exists in the form of small spherical tumors, varying between the size of a pea and an egg, which stud the outer surface of the organ or project into its cavities. Cases occur in which it is seen in layers several lines in thickness, or where it is infiltrated into the muscular texture, converting it into a yellowish substance. Recamier has found the heart partially converted into scirrhus matter, like the skin of bacon; and a case is mentioned in the Memoirs of the Royal Society of Medicine of Paris, for 1776, in which a carcinomatous ulcer, more than three inches in diameter, occupied the whole posterior surface of both ventricles. The cardiac tissue around was indurated and scirrhus; and the bottom of the ulcer was formed by a thin stratum of muscular fibres, so soft and friable as to break down under the slightest pressure of the finger. The heart itself was greatly enlarged, and the pericardium had almost entirely sloughed away. The subject of this remarkable case was a woman twenty-two years old: she complained of sharp, lancinating pains, darting from the left side of the chest towards the centre of the sternum, had frequent attacks of swooning, and was obliged constantly to remain in a semi-erect posture, with the head bent upon the chest, and the body slightly inclined backwards and towards one side. A singular case of scirrhus of the heart is mentioned by Billard. It occurred in an infant only three days old, and consisted of three tumors, which were firmly embedded in the muscular substance.

*Melanos* of the heart has been observed only in a few instances. Of these the most interesting, perhaps, is that recorded by Cruveilhier, which involved both the fleshy substance of the organ and the pericardium.

*Tubercles* are very rare. Bouillaud, who has written two volumes on the diseases of the heart, affirms that he has never met with them in this organ; and he is inclined to believe that they are more rare here than in almost any other part of the body. Andral and Laennec never saw more than three or four instances. Recently Dr. Townsend,† of Dublin, has published a case in which this heteroclitic deposit was situated in the substance of the

\* See his *Morbid Anatomy of the Gullet, Stomach, and Intestines*, second ed., p. 300.

† *Dublin Journal of Medical and Chemical Science*, January, 1833.



left auricle, between the outer and inner membranes, and so compressed the pulmonary veins that they would scarcely admit the smallest probe. The right auricle and ventricle were greatly dilated; but in other respects the heart was sound. The bronchial glands and lungs contained some tubercles, and were otherwise diseased. The patient was a male, sixty-two years old. An interesting case of this disease in a female child, twenty months of age, was reported a few years ago in the New York Medical Gazette, by Dr. C. R. Gilman, Professor of Obstetrics in the College of Physicians and Surgeons. The tubercular masses, which were small and two in number, were embedded in the wall of the left ventricle, and numerous little bodies of a similar nature existed in the pericardium and peritonæum. The abdominal viscera were extensively agglutinated, and the mesenteric glands very much diseased.

*Serous cysts* have occasionally been seen in the muscular structure of the heart; but their occurrence is so infrequent, and their mode of origin so obscure, that it is hardly necessary to do more than allude to them in this place. Examples of the kind have been recorded by Bonetus, Houlier, Rolfinck, Val-salva, and Morgagni among the ancients; by Dupuytren and Andral among the moderns. In a case mentioned by the latter, the serous cyst was embedded in the substance of the left ventricle; it was filled with a thin, limpid fluid, and was about the size of an ordinary walnut.

*Hydatids* have also been discovered in the cardiac substance; but still more rarely than serous cysts. I have not met with any examples, nor am I aware that any have been noticed by American physicians. In a preparation described by Mr. Hodgkin, acephalocysts of various sizes, sufficient to fill a quart measure, were found between the close pericardium and the substance of the heart, from which they extended beneath the pulmonary pleura of the right side. In the eleventh volume of the Medico-Chirurgical Transactions of London, an instance is reported by Mr. Price, in which "a large hydatid was found in the muscular substance of the heart" of a boy ten years of age. In the same work, volume seventeenth, Mr. Evans relates the particulars of a case, in which the tumor was situated in the apex of the organ. It was of a globular form, smoothed and polished, about three inches in diameter, and projected considerably into the cavity of the right ventricle, being covered internally by the endocardiac lining, and externally by a thin layer of muscular tissue. The main cyst contained a number of hydatids, precisely of the same character as those usually seen in the human liver, and varying in size from that of a pea to that of a pigeon's egg, the interstices between them being occupied by a soft, curd-like substance of a yellow color. The other parts of the organ were natural. The subject of this interesting case was an unmarried female of about forty years of age.

7. In the *fatty* transformation, the heart is converted into a substance having all the physical and chemical properties of grease. The apex is the part most commonly affected, but in some instances the infiltration pervades the entire organ, changing it into a pale tawny structure. In the few cases which I have observed of this lesion, the muscular substance was remarkably soft, thin, flabby, and greasy to the touch. It is most common in old age. Its causes are unknown.

The heart, like the voluntary muscles, is subject to *sanguineous effusions*; the lesion, however, is very infrequent, and is seldom met with unconnected with scurvy and putrid fevers. The blood may occur in small superficial patches, or petechial spots, or it may be infiltrated among the fleshy fibres, or, finally, it may be collected into a factitious cavity, and thus constitute what Cruveilhier has called *apoplexy of the heart*. In whatever form it is

poured out, it exhibits the same appearances as in apoplexy of the brain and other parenchymatous organs, being dark and fluid in recent cases, but red and coagulated in those of longer standing. The muscular fibres may be perfectly sound, as is observed when the lesion is very slight or superficial, or they may be broken down and extensively separated. In the latter case the effusion can scarcely fail to be a cause of rupture of the heart. It is worthy of remark that this lesion is almost exclusively confined to the left ventricle, and that it generally coexists with hypertrophy.

8. The heart, like the rest of the muscular system, is liable to *atrophy*; but this affection is much less frequent than the one just noticed. The wasting is occasionally very great. Burns gives several cases in which the volume of the adult heart was not larger than that of a young child; and in one instance it scarcely exceeded that of a new-born infant. Similar examples are detailed by Bertin, Bouillaud, Hope, Carswell, and other writers.

It is rare, however, that the atrophy is either so general or so extensive. In the majority of cases coming under my own observations, I have found it limited to particular parts of the organ, more commonly to the right ventricle, the right auricle, and inter-auricular septum. The color and consistence of an emaciated heart are seldom much altered; frequently, indeed, they remain perfectly natural, or are even augmented. It has been said that, when the atrophy is very great, the organ often presents a puckered and shrivelled appearance, like an old withered apple; but such a condition I have never witnessed, and feel disposed to doubt the possibility of its occurrence. The cardiac chambers in this affection may remain natural, be diminished, or dilated, very much as in hypertrophy. Conjoined with dilatation, the walls of the heart are sometimes so thin as to exhibit quite a translucent, web-like aspect, and so weak as to be liable to break on the application of the slightest force.

Atrophy of the heart usually occurs in persons who are worn out by lingering and exhausting diseases, terminating in general emaciation of the body. Hence it is not unfrequently found in connection with organic affections of the lungs and bowels, dropsy, diabetes, cancer, and other incurable disorders. Excessive bleeding, especially when united with great abstinence, ossification of the coronary artery, and protracted compression from enlarged lymphatic glands or effused fluids, may also be so many causes of atrophy of the heart. In one instance I found it connected with permanent closure of the inferior cava and extensive disease of the abdominal organs, with collection of water in the peritoneal sac. There are no symptoms which can be regarded as diagnostic of this affection. The pulse is generally faltering, and the cardiac impulse scarcely perceptible.

9. *Hypertrophy* is an excessive growth of the muscular substance of the heart, resulting, as the name literally implies, from increased nutrition, without any obvious change of texture. The true nature of this affection, of which there are three varieties, was first pointed out by Dr. Bertin, of Paris, in 1811. In the first and most simple variety, the walls of the heart are merely thickened, the cavities retaining their natural dimensions; in the second, they are augmented in bulk, and the corresponding chambers dilated; in the third, they are thickened and the cavities contracted.

In the majority of cases, the abnormal growth is confined to the walls of the ventricles, of which the left is more prone to suffer than the right.\* Seldom

\* A recent observer, Dr. Swett, of New York,\* is disposed to think, that, when the enlargement of

† New York Jour. Med. and Surgery, No. 5 p. 2.

do the auricles participate in it ; on the contrary, they generally remain sound, even when the rest of the heart is enormously enlarged. — a circumstance which probably depends upon the paucity of their muscular fibres. Occasionally the hypertrophy exists only in particular parts, as the base, apex, inter-ventricular septum, or fleshy columns.

A hypertrophous heart is usually more firm and red than natural ; but these are not essential characters ; and, when present in a high degree, they constitute the affection which has been already noticed under the name of induration. The increase in the thickness of the walls of the organ varies in different cases ; it may be two, three, or even four times the ordinary volume. In a remarkable instance of general hypertrophy, conjoined probably with dilatation, related by Dr. Wright,\* of Baltimore, the heart, after being injected, weighed five pounds, three ounces, its circumference at the base being seventeen inches and a half, near the apex twelve inches and a half, and its length, from the top of the right auricle to the point of the left ventricle, thirteen inches. An example of general hypertrophy of the heart, not less extraordinary than the one just mentioned, I had occasion to observe in a boy, seven years of age, whose body I examined along with Dr. Wood and Dr. Ridgely, of Cincinnati. The organ was of an obtuse conical shape, and considerably larger than we usually find it in the adult, its weight being ten ounces and a half after the removal of the great vessels. The thickness of the wall of the right ventricle was three lines ; of the left, six lines and a half. The inter-ventricular septum was also unnaturally stout, and the parietes of the auricles were nearly double the normal dimensions ; the cardiac chambers had a correspondingly increased capacity ; the pericardium adhered every where very closely to the outer surface of the heart ; the mitral valves were rough and indurated ; and the endocardiac lining of the left auricle and ventricle was very much thickened, opaque, and of a dense, fibrous consistence. The child had labored under all the symptoms of disease of the heart for about eight months. All the other viscera were sound. In such cases, the organ is very apt to become altered in its figure ; it loses its elongated, conical appearance, and assumes a globular shape ; and, instead of lying obliquely in the chest, as it naturally does, it is made to take a transverse position ; and in this way it may encroach so much upon the left lung as to force it high up into the thoracic cavity. When great enlargement is accompanied with adhesion of the pericardium, the heart is secured by the attachments of the membrane in a higher situation than its weight would otherwise dispose it to assume ; and, being thus impacted between the spine and fore part of the chest, it sometimes occasions a preternatural prominence of the præcordial region.

The *left ventricle*, as was before intimated, is much more liable to hypertrophy than the right, and often grows to a very considerable bulk. In my own dissections, I have never seen the thickness exceed an inch and a quarter ; but cases are recorded in which it amounted to an inch and a half, an inch and three-fourths, and even two inches. The situation of the greatest increase is commonly somewhat above the middle of the ventricle, opposite the attachment of the fleshy columns. From this point it diminishes rather suddenly towards the aortic orifice, and gradually towards the apex, where it is reduced

the heart is partial, the left side is affected in the proportion of seventeen to eight. The hypertrophy is general, he supposes, in one case out of every three. These conclusions are founded upon an analysis of forty-eight examples of this malady ; a number entirely too small to warrant such a deduction. Louis asserts that of forty-nine instances of hypertrophy of the ventricles, twenty-nine occurred on the right side.

\* American Journal of the Medical Sciences, vol. xii., p. 54.



to less than one half. Generally speaking, the fleshy columns participate, though occasionally, especially when there is much dilatation, they appear to be flattened and emaciated. When the hypertrophy is very great, the ventricle may not only occupy the left præcordial region, but extend far under the sternum, where its impulse and sound may be mistaken for those of the right.

In hypertrophy of the *right ventricle*, whether alone or coexistent with that of the left, the greatest thickening is generally near its base, where it often amounts to twice the natural bulk. Increase of substance without dilatation is much more infrequent in the right than in the left ventricle; and, what is remarkable, the growth is much oftener noticed in the fleshy columns than in its walls, being sometimes so curiously interlaced as to traverse the cavity in every direction, subdividing it into various compartments, and, in some cases, almost filling it up. When the ventricle in question is alone hypertrophied, it may descend lower than the other, and so form the summit of the organ.

Hypertrophy of the *auricles* is almost invariably conjoined with dilatation, but the two other forms are not without example. The thickening seldom exceeds twice the natural size, and, as it is even then inconsiderable, it may be easily overlooked by a superficial observer. Sometimes the pectinate muscles are the only structures in which the hypertrophy shows itself: more commonly it is uniformly diffused throughout the walls; and, as these are naturally thicker in the left auricle than in the right, it is in the latter that the increase generally attains its greatest height.

Hypertrophy of the walls of the ventricles generally results from great and habitual accumulations of blood in their cavities, produced by disease of the semi-lunar valves, or contraction of the mouth of the aorta and pulmonary artery. In the same way may arise hypertrophy of the auricles; or it may be occasioned, more directly, by a narrowing of the auriculo-ventricular apertures, preventing the ready ingress of blood from one chamber of the organ into the other. Hypertrophy of the right side is also frequently dependent upon disease of the lungs, as tubercles, emphysema, and hepatization of their tissue.

A very extraordinary case of hypertrophy of the heart of the horse is related by Mr. Thomson, of England, in a periodical entitled "*The Veterinarian.*" The animal died of acute rheumatism, and had been worked constantly on the farm to within a few days of its death. The lungs and pleura were much inflamed; the pericardium was distended by fluid; the heart was of enormous size and greatly inflamed; both the auricles and ventricles were filled with coagulated blood; nearly all the chordæ tendineæ had given way; the valves were widely separated from each other, and the heart altogether presented a large disorganized mass, weighing thirty-four pounds.

An increase of the muscular substance of the heart necessarily implies an increase of power; hence one of the most prominent effects of this state is to force the blood with more vigor and velocity upon the different tissues and organs. Let us suppose that the individual is laboring under hypertrophy of the left ventricle. He will have a strong, bounding pulse, frequent attacks of headache, bleeding at the nose, ringing in the ears, and perhaps he will ultimately die of cerebral apoplexy,—all these circumstances depending not so much, as it is supposed by some, upon the increased amount of blood sent through the systemic circulation as upon the power with which it is impelled by the overgrown ventricle. In the same manner, hypertrophy of the right ventricle may produce engorgement of the pulmonary tissue, with all the train of secondary effects, such as apoplexy, œdema, and dyspnœa, which are known to result from habitual accumulations of blood.

The physical signs of hypertrophy consist in increased impulsion of the heart

against the walls of the chest, diminution of the natural sound, and dulness on percussion. In the simple form of the disease, as well as in that with dilatation, the sound is sometimes nearly lost, or converted into an obscure purring.

10. Occasionally we find that the chambers of the heart, instead of being diminished in size, are dilated, so that their capacity is much greater than in the normal state. This condition of the organ, which was described by Corvisart under the name of *passive aneurism*, may be either general or partial, that is, it may exist in all the cardiac cavities at the same time, or be limited to the auricles, the ventricles, or to one of these reservoirs alone, which is, in fact, most commonly the case. Universal dilatation is extremely infrequent. The heart in this state seems to be sometimes much increased in weight. In a case mentioned by Burns, in which all the chambers, both auricular and ventricular, were equally dilated, the organs was larger than that of an ox, and weighed two pounds, its muscular substance being throughout of the usual thickness.

Dilatation of the heart may be conveniently arranged under several varieties. The first consists of dilatation with hypertrophy; that is, one or more of the chambers of the heart are enlarged, and the corresponding walls thickened: the second variety is the simple dilatation, in which the cavities are augmented, whilst the corresponding parietes retain their normal state: the third consists of dilatation with atrophy; that is, one or more of the cardiac reservoirs are enlarged, and the corresponding walls attenuated: a fourth, and much the rarest variety of all, that which truly deserves the name of aneurism, is where there is a pouch or blind sac leading from, and communicating with, the affected cavity. These different forms, especially the first three, sometimes coexist in different parts of the heart, or even in different parts of the same chamber; and several of them are very commonly found in conjunction with hypertrophy.

Of the first and third varieties of the disease it is not necessary to make any particular mention, beyond the fact that, in the one the walls of the heart are always natural, in the other hypertrophied. The dilatation is generally partial, and is most frequent in the left ventricle.

In dilatation with atrophy there is often softening of the muscular structure, with an alteration of color, which, instead of a florid red, is either pale grey, cinnamon, brown, or purple. The emaciation varies in different cases, being sometimes so great that the most substantial portion of the organ is scarcely more than the eighth of an inch in thickness. The fleshy columns are stretched and attenuated; and occasionally, though very rarely, the muscular structure is so much unfolded that the whole heart looks like a membranous pouch. Extreme emaciation is more common in the right than in the left ventricle, in the right than in the left auricle; a circumstance easily accounted for by the natural difference of thickness between the two sides of the organ. Formerly this variety of dilatation was regarded as a very frequent lesion; but more recent observation has shown that this opinion is erroneous.

The fourth variety of dilatation, also comparatively rare, presents itself in the form of a pouch in the walls of the heart, and constitutes the *lateral or sacculated aneurism* of authors. It occurs almost exclusively on the left side of the organ. In sixty seven cases analyzed by Mr. Thurman,\* it affected the ventricle in fifty-eight, the left auricle in nine.

Lateral aneurism of the left ventricle exists under two principal forms,

\* See the very able paper of this gentleman, "on Aneurisms of the Heart," in the twenty-first volume of the Medico-Chir. Trans. of London.

either without external deformity, or as a tumor varying in size from that of a nut to that of the heart itself. The sac is generally of an elongated globular shape, and almost always contains, especially when of long standing, a number of dense, laminated concretions, or reddish amorphous coagula; it communicates with the corresponding cardiac chamber either by a wide orifice, often as large as the sac itself, or, as is more commonly the case, by a narrow, rounded opening, with hard, prominent, and well defined margins. Its parietes may be formed by all the component structures of the heart, by the muscular fibres and pericardium, or, finally, by the pericardium and endocardium alone. Although there is seldom more than one sac, yet sometimes there are two, three, and even four. The parts of the left ventricle most frequently affected are those which are thinnest, namely, the apex and the highest point of the base. The heart in this affection may be perfectly natural; but in general it is more or less changed by disease, atrophied, dilated, or hypertrophied; the pericardium, endocardium and mitral valves are also frequently altered.

As respects the influence of sex, in forty cases in which this is recorded by Mr. Thurman, in the work alluded to, thirty occurred in males and ten in females. In thirty-five patients, mentioned by the same writer, the youngest was eighteen, the oldest eighty-one. The whole of the cases except the two just indicated, may be arranged in decennial periods, as follows:

Age.							Number of cases.
From 21 to 30	-	-	-	-	-	-	9
31 „ 40	-	-	-	-	-	-	4
41 „ 50	-	-	-	-	-	-	3
51 „ 60	-	-	-	-	-	-	6
61 „ 70	-	-	-	-	-	-	4
71 „ 80	-	-	-	-	-	-	7

“From this analysis, it appears,” says Mr. Thurman, “that, after adult age, cardiac aneurism is not remarkably confined to any particular period; although it would seem to prevail with the greatest frequency at two distinct periods, or between the ages of twenty and thirty, and again in very advanced life. In this respect, then, we likewise find that cardiac aneurism differs remarkably from arterial, which, according to the experience of Sir Astley Cooper, and also from an analysis by M. Bizot,\* prevails chiefly between the ages of thirty and fifty.”

Aneurism of the auricles is still more infrequent than that of the ventricles. It is seldom that the disease is distinctly circumscribed or sacculated; on the contrary, it is generally pretty uniformly diffused over the entire sinus. In all the cases examined by Mr. Thurman, and which are nine in number, the disease existed on the left side, and was connected with and apparently dependent upon an extreme contraction of the mitral orifice, impeding the passage of the blood from the left auricle to the corresponding ventricle. “The dilated walls of the cavity are often thickened, and the seat of fibro-cellular degeneration. The lining membrane is opaque, rough, and otherwise diseased,—in some cases even ossified,—and is lined with fibrinous layers, very similar to those met with in arterial aneurisms. Occasionally the dilatation is confined to the auricular appendage, which becomes excessively distended with lamellated concretions.”

The causes of dilatation of the heart are, valvular disease, narrowing of

\* Mém. de la Soc. Méd. d'Obs., t. i., p. 409. Recherches sur le Cœur et le Système Artériel.



the auriculo-ventricular orifices, contraction of the mouth of the aorta or pulmonary artery ; in short, whatever has a tendency to impede the passage of the blood from the auricles into the ventricles, or from the ventricles into the great arteries connected with their base.

11. On the subject of *rupture* of the heart, very little need be said in concluding our remarks on the different affections of the cardiac tissue. This accident is generally the result of softening, excessive deposition of fat, ulceration, or chronic inflammation, and seldom occurs except in persons above fifty or sixty years of age.

Of thirty-four cases of this lesion, collected by Dr. Hallowell,\* of Philadelphia, and including two which occurred under his own observation in the Salpêtrière Hospital in Paris, the precise period of life is stated only in twenty-three. Of these nine were between seventy and eighty, six between sixty and seventy, five between fifty and sixty, two between forty and fifty, and one between twenty and thirty. Sixteen of the thirty-four individuals were males, and eighteen were females. The rupture occurred, for the most part, in the left ventricle, near the middle of the anterior wall. In thirty-one of the cases the seat of the lesion was three times in the right auricle, twice in the right ventricle, and twenty-six times in the left ventricle. From these data it may be inferred that rupture of the inter-ventricular and inter-auricular septa is very infrequent.

The cardiac tissue, around the place of rupture, is usually in one of the following conditions: 1. Perfectly healthy: 2. In a state of ulceration: 3. Hypertrophy, with or without mollescence: 4. Softened to a greater or less extent: 5. Expanded and attenuated: 6. In a state of partial dilatation: 7. Transformed into fatty matter. Cases of the first kind, or where the muscular walls are perfectly sound, are extremely rare. Those of the second class are the most common, and next in point of frequency are those attended with hypertrophy, with or without softening. Rupture from partial dilatation and fatty degeneration has been very seldom observed.†

The quantity of blood poured out through the accidental opening varies from a few ounces to one or two pints. When considerable, the pericardium forms a large, bluish, and elastic bag, and the heart is completely concealed by the sanguineous mass, which is either in a liquid, semi-fluid, or coagulated state, and of a dark venous color.

From whatever cause proceeding, laceration of the heart is almost always followed by immediate death. Of ten patients mentioned by Bertin, eight died instantaneously, and the other two after a few hours. The cause of these disastrous consequences appears to be not so much the extent of the hemorrhage, as the great and sudden shock sustained by the nervous system, together with the mechanical compression of the cardiac chambers. If the patient survives the accident several days, the rent is generally plugged up by a clot of fibrin, in the same manner as sometimes happens after the reception of a wound. In some instances there would even seem to be an effort made at cicatrization.

A species of partial rupture of the heart, consisting in a laceration of the fleshy columns and tendinous cords of the valves, is mentioned by Corvisart, Bertin, and Laennec. The causes are violent exertions, as coughing, sneezing, or retching, and the symptoms a sudden sense of suffocation, overwhelming faintness, and great anxiety of the countenance, followed by all the phenomena of organic disease of the heart. The valves themselves are occasion-

\* Amer. Journ. Med. Sciences, vol. 17, p. 75.

† Hallowell, *op. cit.*, vol. 17, p. 76.

ally ruptured; the lesion, however, is rare, and does not require particular notice.

The opening, which usually presents itself in the form of a slit or fissure, varies in size in different cases. While it seldom exceeds half an inch, it is sometimes so small as to be scarcely perceptible, and at other times so large as to admit two or three fingers. In an instance mentioned by Bouillaud, the rupture extended from the base to the summit of the left ventricle. The fissure generally runs in an oblique direction, has a ragged, shreddy appearance, and is often narrower at the inner than at the outer surface of the heart. When there are two or more apertures their tortuous grooves or canals occasionally unite and form a common communication with the corresponding cavity. This, however, is rare. The slit, although ordinarily parallel with the longitudinal axis of the heart, may be oblique or even horizontal.

Nor is the aperture always single. Two, three, or even more, are sometimes met with. In forty-nine cases of this lesion, collected by Dr. Ollivier, of Angers, the rupture was multiple in not less than eight.\* In two instances recorded by Rostan two slits existed towards the apex of the left ventricle. Morgagni relates an example of three openings, and a similar one is mentioned by Portal. In 1824 Mons. Andral exhibited to the Royal Academy of Medicine at Paris a heart in which there were five perforations in the posterior wall of the left ventricle. Bland also met with five lacerations at the same time, but only three of them communicated with the interior of the organ. In a case published by Dr. Ashburner in the London Medical and Physical Journal for December, 1822, three ruptures existed — two on the left, and one on the right ventricle.

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### SECTION III.

#### OF THE ENDOCARDIUM.

Of the anatomy of this membrane we have already spoken. It only remains, therefore, that we point out its lesions. Of these, the most important is acute inflammation, technically called endocarditis.

*Endocarditis* is anatomically characterized by redness, thickening, and opacity of the affected membrane, with deposition of lymph on its free surface. Redness alone cannot be considered as indicative of inflammation, as the same appearance is produced by cadaveric imbibition. The color varies from a light rose to a scarlet, violet, or even brownish tint, and ordinarily occurs in small circumscribed spots, which are always most conspicuous on the valves. Sometimes it is universal, and, on the other hand, it may be occasionally entirely wanting. The redness seems to depend rather on a tinging of the endocardium than on true capillary injection; and, although it seldom extends into the subjacent cellular texture, it cannot be easily washed away.

In acute inflammation the endocardium is rarely much thickened; under the influence of chronic irritation, on the contrary, it often acquires the density and consistence of a fibrous membrane. In the healthy state it is perfectly

\* Bouillaud, *Traité Clinique des Maladies du Cœur*, t. ii., p. 512.

smooth, polished, and so firmly adherent that it can be detached only in very small shreds; but, under protracted disease, it becomes opaque, rough, of a milky white, and can be easily raised in considerable patches. Occasionally the thickening is entirely dependent upon hypertrophy of the subjacent cellular tissue, or it may be produced by a layer of adventitious membrane.

In very acute cases, there may be softening of the endocardium, with an infiltration of pus, serosity, or bloody matter into the subjacent cellular texture. Ulceration also is sometimes observed, and may proceed to such a degree as to lead to perforation of the muscular substance.

Endocarditis, although noticed by previous observers, was first accurately described by Dr. Bouillaud, in his elaborate treatise on the Diseases of the Heart, published at Paris in 1835. The extensive investigations of this distinguished pathologist induce him to assert, in opposition to many able writers, that this disease is quite as common as pericarditis; that it is often produced by the same causes, and that it frequently coexists with and cannot be distinguished from it. The characters which he assigns to this affection, but which, as they are not invariably present, cannot be viewed as diagnostic, are, increased cardiac impulse, præcordial dulness on percussion, and violent palpitations, accompanied with a distinct bellows murmur, and sometimes with a metallic tinkle, isochronous with the ventricular systole. The beating of the heart against the side of the chest is usually very strong, sometimes like a hammer, extensive and superficial, being recognizable both by the eye and hand. There is seldom much pain or dyspnœa, unless the lesion is coincident with pericarditis or pleuritis, or there is much obstacle to the circulation. In the acute stage, the disease may terminate fatally in a very few days, the principal cause of death being the formation of extensive fibrinous concretions, which fill up the cardiac cavities, and obstruct the passage of the blood.

It has been already stated that one of the morbid effects of endocarditis is the deposition of lymph upon the inner surface of the lining membrane. Though sometimes poured out as a distinct lamella, this substance more commonly occurs in the form of small *granulations*, varying in size between a pin-head and a cherry-stone. These bodies display a peculiar preference for the mitral and aortic valves, especially for their free borders, to which they adhere with considerable tenacity when old, though when recent, as they are then soft, they are easily detached: they are of a light pink color, whitish or yellowish, somewhat darker internally than externally, and are sometimes so clustered together as to give the surface on which they grow a rough, granulated aspect, not unlike that of a fungous ulcer. These bodies are often organized; and in their nature they may be considered as strictly analogous to the concretions which are so frequently met with on the surface of the pericardium, pleura, and peritonæum, in chronic inflammation.

Somewhat similar to these granular concretions are those *wart-like excrescences* of the heart, the existence of which was first clearly indicated by Laennec, who has described them under the name of *globular vegetations*. Commonly of a spherical shape, they are of a pale straw color, smooth externally, and encased by a distinct cyst; their size varying between that of a pea and a pigeon's egg. These singular bodies sometimes exist in considerable numbers, both in the auricles and ventricles, to the inner surface of which they adhere by narrow footstalks, occasionally more than a third of an inch in length. The capsule, usually about a fourth of a line thick, firm and organized, is filled with a dark greyish-looking, semi-fluid substance, somewhat similar to coagulated blood, or the lees of red wine. In some instances, the surface of these excrescences is rough, mammillated, raspberry-like, or divided off into numer-



ous facets resembling those of a crystallized garnet. They may be so closely grouped together as to present the appearance of a cauliflower.

These globular vegetations are of very rare occurrence; and their origin seems to be still involved in considerable obscurity. From the fact, however, that they generally coexist with chronic endocarditis and inflammation of the aorta, I am led to the conclusion, that they are caused by a deposition of bloody lymph, which assuming, perhaps in consequence of the constant movements of the circulating current, the form and color above described, in time becomes perfectly firm, dense, and organized. Corvisart\* supposes that they are of a syphilitic origin; but the opinion is evidently groundless.

These bodies do not give rise to any characteristic symptoms, yet Bouillaud seems to be inclined to suspect their existence, when there is a well-marked bellows sound, unaccompanied by any other indication. When seated on the valves, especially if very large and numerous, they must necessarily interfere with their action, and materially diminish the auriculo-ventricular orifices and the mouths of the great vessels.

As consequences of chronic inflammation, it is by no means uncommon to meet with *fibro-cartilaginous* and *osseous degenerations* of the endocardium. The most frequent seats of these lesions are the circular zones around the auriculo-ventricular orifices, together with the adjacent valves. They may occur at all periods of life, but the age which seems to be most prone to them is between forty and sixty. Occasionally they are seen in children; and Bouillaud mentions a case in which he found them in an infant only ten months old. Like the tubercular and warty excrescences, just described, these transformations are much more common in the left side of the heart than in the right, though they are by no means confined to it, as is thought to be the case by Bichat and some others.† The cause of this remarkable difference is not well understood. That it depends upon some difference of organization of the endocardiac lining of the opposite chambers of the viscus cannot be reasonably doubted. The arteries, we know, are extremely liable to these degenerations; and, as their internal tunic is continued into the left cavities of the heart, whilst the right are lined by a prolongation from the internal coat of the veins, it is highly probable that the same cause which operates in the production of these lesions in the former of these structures, is of the same character as that which produces them in the latter, and conversely. Bertin ascribes the difference to the nature of the fluid which traverses the two sides respectively, the left receiving blood of a more vital, acrid, and stimulating quality than the right; and Dr. Hope‡ supposes that it depends upon the greater energy of action of the left ventricle, by which the endocardiac lining, with the corresponding valves which are framed out of it, is more severely strained. A somewhat similar notion is entertained by Cruveilhier.

In the fibro-cartilaginous transformation, the endocardium is often remarkably thickened, corrugated, opaque, and of a pale milky color. Not unfrequently, indeed, the membrane is of the consistence and tenacity of tendon, or of a truly cartilaginous hardness, with a creaking sound on being cut. In this advanced stage, bony depositions usually occur, forming gra-

\* See Corvisart, *Essay on Organic Diseases of the Heart*, p. 172; and Morgagni, on the *Seat and Causes of Disease*. The latter author saw a case in a girl of sixteen, in which the valves of the pulmonary artery were so indurated and ossified, that their agglutinated edges scarcely left an opening as large as a lentil for the passage of the blood.

† For a most interesting case of this disease, illustrated by several very graphic wood cuts, the reader is referred to the fifteenth volume of the *American Journal of the Medical Sciences*, where it has been detailed by Professor Jackson of Philadelphia. It occurred in a man aged fifty-four, and was complicated with pericarditis, dilatation of the heart, and œdema of the larynx and fauces.

‡ Hope, on *Diseases of the Heart*, p. 311.

nules, patches, scales, or nodules of various sizes, rough, opaque, whitish, or yellow. The ossifications, in most cases, assume a very irregular shape; and occasionally they penetrate deeply into the muscular substance of the heart itself. For the most part, they are seated on the valves, which are often perforated with holes, torn, reticulated, or almost entirely detached, though these morbid appearances are by no means common.

The tissue in which the ossific deposition begins seems to be the cellular, which binds the endocardium to the muscular substance, and which is evidently somewhat of a fibrous nature, especially where it connects the folds which constitute the valves. From thence it gradually extends to the endocardium itself, and occasionally even to the muscular substance.

Amongst the most serious lesions resulting from cartilaginous and osseous degeneration of the valves of the heart, is the contraction of the auriculo-ventricular and arterial orifices. In its extreme degree, the point of the little finger, or even a quill, can scarcely pass. Sometimes the valves become consolidated with each other, leaving merely a small, rounded, oval, or elliptical aperture, through which the blood is forced with so much difficulty that hypertrophy and dilatation, with various other diseased conditions, are sooner or later the inevitable consequences. Cases occur in which the valves form adhesions with the walls of the heart, giving rise to pretty much the same symptoms as those which result from contraction of the orifices.

The valves of the heart are sometimes so much dilated as to present the appearance of elongated, pouch-like projections, which may properly enough be styled aneurismal. The lesion may occur in any of the valves, the mitral, the aortic, and even the tricuspid, but is most common in the former, which, when thus affected, forms a sort of flask-like protrusion in the left auricle. The pouch varies in size from that of a small nut to that of a duck-egg, and is always free from coagula or fibrinous concretions, differing in this respect from the common cardiac and arterial aneurism. The valve is generally opaque, and more or less changed in its structure; in some cases it is perforated, or pierced with small holes. The effect of such a pouch must be to obstruct the transmission of the blood and favor regurgitation.

The *diagnosis* of induration of the valves with contraction of their orifices has been very happily elucidated, within the last few years, by Bouillaud, who considers it quite as easy and certain as that of stricture of the urethra or rectum, by the most skilful surgeon. The most important physical signs upon which our reliance is to be placed, are the bellows, rasping, or sawing sound; a peculiar vibratory sensation imparted to the hand; and an irregular, intermittent, and tumultuous action of the heart. When these phenomena are present, it is in the highest degree probable that the lesion is the one in question; and the suspicion is fully confirmed, when to these signs are added those of impeded circulation, — such, for example, as discoloration of the countenance, congestion of the lungs, dyspnœa, bleeding from the nose, and beating of the jugular veins, synchronous with the pulse.

*Fibrinous concretions*, regarded by the older anatomists and pathologists as genuine polypes, are occasionally met with in the interior of the heart, though not near so frequently, I think, as was at one time imagined. Partially or completely organized, they adhere with more or less tenacity to the inner surfaces of the organ, especially to the fleshy columns and tendinous cords of the valves, around which they are sometimes inextricably coiled. In their early state they are attached solely through the medium of plastic lymph, or, what is not improbable, by the adhesive matter of the blood; after a while, however, as they increase in age, they adhere by a sort of adventitious membrane, which is ultimately transformed into short, dense, cellular tissue, the

laceration of which leaves a marked roughness both on the concretion and on the endocardiac lining. The older bodies occasionally contain small, straggling vessels, some of which evidently communicate with the heart; while those of more recent formation often exhibit minute bloody points, which are probably the rudiments of arteries and veins, or, at all events, the indications of incipient vascularization.

At an advanced period of their existence, these bodies are generally of a pale buff-color, pink, greyish, or even slightly violet, opaque, dense, elastic, and distinctly fibrous in their texture. Their interior is sometimes softened, pultaceous, or friable, or even occupied by purulent matter;\* they often exhibit a lamellated arrangement; and occasionally, though rarely, they are interspersed with specks of bone, or minute cells or vesicles, filled with serous, sanious, or semi-concrete fluid.

Varying in size from a filbert to a pullet's egg, these concretions may be so voluminous as to encroach materially upon the cavity in which they are lodged. They may be confined to one chamber of the heart, or occur simultaneously in two, or even more; or they may even extend into the great vessels, particularly the two hollow veins. In their form they are cylindrical, conical, pear-like, flattened, reticulated, arborescent, or pedunculated. In some cases they are pretty accurately moulded to the cavity in which they are situated, or to the surfaces to which they are attached.

Writers generally suppose that these concretions are most common on the right side of the heart; and, so far as my own observation extends, I have seen nothing to invalidate this opinion. The reverse, however, is asserted by Dr. Hope;† and the following table, drawn up by Dr. H. M. Hughes‡ of London, and founded upon sixty-two examples of these formations, is calculated to confirm his conclusion:—

32	on the right side.
38	on the left side.
15	in the right auricle.
21	in the right ventricle.
14	in the left auricle.
27	in the left ventricle.
7	in the right and left side at the same time.
4	in the right auricle and ventricle.
3	in the left auricle and ventricle.
2	in both auricles.
6	in both ventricles.
1	in all the cavities.
1	in both ventricles and the right auricle.
1	in the right auricle and left ventricle.

\* Respecting the source of this purulent fluid authors are not agreed. Legroux regards the pus as a product of the inflammation of the concretion which contains it. Bouillaud, on the other hand, without denying the possibility of this occurrence, supposes that it is either secreted in the cavity of the heart, or transported thither by absorption, and so occasioning the formation of a coagulum, which entirely envelopes it. (*Traité*, ii., p. 610), Dr. Hope adopts the opinion which ascribes the pus to inflammation, as being more in accordance with the suppuration of coagula which are so constantly found in phlebitis, and because he thinks that pus in the circulation would be mixed *equally* with the blood, and not collect in particular points. "I do not," says he, "even believe that what are called *purulent depositions* in organs really consist of particles of pus deposited by the blood; but that pus poisons the blood, and occasions its coagulation and suppuration in the spots affected. In this point of view, I do not deny that particles of pus may be the nuclei of coagula within the heart; for I have seen such coagula, some suppurating and others not, floating loose in almost every considerable venous trunk through the system of the same patient." (*Treatise*, p. 484.)

† *Treatise on the Diseases of the Heart*, by Dr. Pennock, p. 483.

‡ *Guy's Hospital Reports*, April, 1839, p. 160.



The cases, from which the above table was constructed, were collected by Dr. Hughes from the writings of different pathologists, including a number that occurred under his own observation. He has evidently devoted much attention to the study of these concretions, and in the work referred to he has published the most elaborate and ingenious article that has yet appeared upon their physical character and mode of formation. He arranges them under four distinct heads: the polypoid, the massive, the parietal, and the globular; the latter of which does not differ from that noticed in a preceding paragraph. The following is a brief account of the first three varieties.

The polypoid concretion is a solid mass of fibrin, of an irregularly rounded figure, varying in size from a filbert to a pullet's egg, of a dull opaque, or dead-white color, with a smooth, even, or slightly wrinkled surface, and attached either by a broad base, or by a small, narrow pedicle. It may be firm, uniform, and lamellated; or soft, pulpy, brittle, and easily crushed: it is often covered with a delicate membrane, and supplied with minute vessels. It may occur on either side of the organ, but is most generally attached to the right surface of the auricular septum.

The massive, or, as it might be more appropriately termed, the amorphous variety, is exceedingly irregular in its form, and frequently sends off processes into the depressions or outlets of the cavity in which it is situated. When most decidedly acute or anti-cadaveric, it is thin and expanded, of a pinkish-white color, firm in its texture, easily separable into layers, and feebly adherent to the plane surfaces of the organ. This variety is occasionally found in all the cardiac chambers.

♫ The parietal, or, as I am disposed to call it, the reticulated form, is remarkably rare. In a case observed by Dr. Hughes the concretion consisted of a general fibrinous lining of the ventricle in which it was developed, and had the appearance of a sort of network, two lines in width by one line in thickness, of yellowish-white color, firm in consistence, and with a smooth, glistening surface. It sent numerous processes among the pectinate cords, and contained a large, blackish clot, without, however, adhering to it.

The formation of these concretions cannot, I think, be altogether owing, as is supposed by some writers, to a retardation of the blood. This doubtless materially contributes to it; but there is reason to believe that it is greatly aided by an effusion of plastic lymph, by which the fibrin of the blood becomes entangled in its passage over the inflamed endocardiac lining. Be this as it may, this substance is soon poured out, so that the adventitious body becomes gradually organized and firmly adherent to the parts with which it lies in contact. The symptoms attending the formation of these concretions are generally obscure; in fact, there is not a single one which can be regarded as pathognomonic.

The fibrinous concretions which we have now described should not be confounded with the *coagula* or *clots* so frequently found in the interior of the heart. The latter, which are never organized, are always formed either immediately before dissolution, in the act of dying, or within a few moments after death, before the solids and fluids have parted with their warmth. They are observed in nearly all our post-mortem examinations, in the form of dark masses which bear the greatest resemblance to the under surface of the crassamentum of the blood. In their shape they are amorphous, or similar to that of the cavity in which they are contained; they are of a black purple color, of a soft jelly-like consistence, easily detached from the parts on which they repose, and varying in size from that of the end of the little finger to that of a pullet's egg. They are most common in the right side of the heart, from

which they often extend, on the one hand, into the great hollow veins, and, on the other, into the pulmonary artery. These coagula are sometimes entirely destitute of red particles, and look very much like a mass of jelly; at other times they consist of two parts, the one dark, soft, and friable, the other white, yellowish, or greenish, and tolerably firm in its consistence.

## CHAPTER XVIII.

### OF THE NASAL, MAXILLARY, AND FRONTAL CAVITIES.

- I. Formation and Structure of the *Nasal Cavities*.—Deviations from the Normal Standard. — Nasal Septum. — Inflammation of the Schneiderian Membrane. — Epistaxis — Different kinds of Polypes. — Obstruction of the Mucous Follicles. — II. *Maxillary Sinus*. — Purulent Accumulations. — Ulceration of its Lining Membrane. — Polypous Growths. — Carcinoma. — Exostoses. — III. Lesions of the *Frontal Sinus*.

I. THE interior of the nose is covered throughout by a mucous membrane, which is continuous, on the one hand, with that of the fauces, and, on the other, with that which lines the various sinuses of the skull. Anteriorly, it is insensibly blended with the skin, and at the inferior meatus it extends up into the nasal canal, spreading over the lachrymal sac, and terminating at length on the surface of the eye in forming the conjunctiva. Thus the Schneiderian membrane, as it is called, has a very extensive distribution, as well as important sympathetic relations; upon which, however, we have not time to dwell in this place.

In its structure, the Schneiderian membrane resembles the mucous textures generally; its color, however, is naturally of a deeper and uniform red; and it is thicker also in some places than in others. Its free surface has a fleecy villous appearance, as may be seen by floating it in water; and it is every where studded with minute crypts, from which proceeds the mucus of the nasal cavities. The other surface is rough, and reposes upon a fibrous membrane, being connected to it by cellular tissue, the density of which varies in different parts of the organ.

The parietes of the nasal cavities are developed by several distinct points, the union of which is effected at the mesial line. The regularity of this formation is much influenced by that of the olfactory nerves, the imperfection of which appears to be always attended with a corresponding imperfection of the parts over which they preside. Cases are recorded in which these nerves were entirely absent, and in which, as a consequence, there was a complete deficiency both of the septum and of the floor of the nostrils.

The external nose, properly so termed, is very rarely absent as a connate vice. A much more common defect is congenital malformation of the *nasal septum*. Of this quite a number of examples have fallen under my own notice, and others have been reported by authors. The defect to which I allude is generally confined to the cartilaginous portion of the septum, but may also implicate the vomer and the nasal lamella of the ethmoid. It consists, for the most part, simply in a lateral curvature, obstructing more or less the corresponding cavity, and leading to indistinct enunciation. The cartilage is occasionally thickened, perforated, or tuberosed, and the external nose deformed; but these are rather accidental than necessary attendants. On the whole, it may be confidently affirmed, that there are few persons in whom the part in question is perfectly vertical.

The most common disease of the Schneiderian membrane is *inflammation*, the anatomical characters of which are the same as in the rest of the mucous system. With the increased redness, there is generally at first a suppression of the natural secretion, which, in a short time, however, is not only restored, but becomes extremely abundant, watery, and so irritating as to excoriate the parts with which it comes in contact. When the inflammation begins to decline, as it usually does in a few days, the secretion assumes a thick yellowish or greenish appearance, is less acrid, and gradually regains its natural standard, both as regards quantity and quality. The sense of smell is very much impaired, indeed often lost. Both cavities are usually affected, and in many instances the disease invades the neighboring parts, as the conjunctiva, the fauces, and the frontal sinuses. Dark-colored spots, evidently caused by the effusion of blood into the submucous cellular tissue, are sometimes observed, and the same fluid is occasionally discharged along with the altered mucous secretion. The Schneiderian membrane between these spots is of a deep florid hue, verging upon purple.

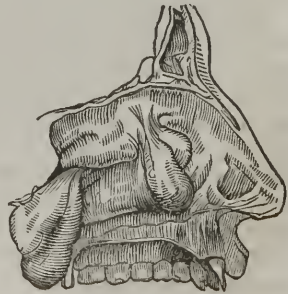
The duration of this affection varies from a few days to several weeks, when it either subsides, passes into suppuration, or assumes the chronic type. Submucous abscesses occasionally form, and are eventually followed by ulceration with an escape of their contents. More frequently, the matter is discharged along with the mucous secretion, unaccompanied with any breach of continuity. In the chronic stage of the disease, the membrane loses its spongy texture, increases in thickness and density, and can generally be easily detached owing to the brittleness of the subjacent cellular tissue. Ulceration sometimes succeeds, and in its progress involves the osseous structure, producing what is called *ozæna*, an affection which is frequently attended with a profuse mucopurulent discharge, of a character the most intolerably fetid. In secondary syphilis, the ulceration is liable to commit the most extensive ravages, destroying the greater part of the nasal septum, the lateral cartilages, and the turbinated bones, and so producing the most unsightly deformity.

Another affection of the nose is hemorrhage, which receives the name here of *epistaxis*. Owing to the great vascularity of the Schneiderian membrane, this is an extremely common occurrence, much more so than in any other part of the body, and is most frequently observed about the age of puberty. In females, it is sometimes vicarious of the menstrual flux. The blood rarely proceeds from both nostrils. In general, only a few ounces are lost at a time. When arising spontaneously, it is almost always the result of exhalation.

The Schneiderian membrane is a frequent seat of polypes, more so, in fact, than any other mucous cavity in the body. These growths may occur at a very early period, but are most common in adults and old people; they often display a malignant tendency, and are generally regenerated when extirpated. In regard to their structure, nasal polypes are divisible into three principal varieties: the gelatinous, the fibrous, and the vascular. The granular form, described in a previous chapter, is much more frequent in the uterus than in the nose, and does not, therefore, merit particular attention in this place.

The gelatinous polype (Fig. 127) generally grows from the mucous membrane over the turbinated bones, never from the median septum. As its name indicates, it is of a soft, jelly-like consistence, smooth, of a white green-

Fig. 127.





ish color, slightly transparent, and striated with a few scattering vessels.

Fig. 128.



Most commonly it has a narrow, elongated neck, with a broad bulbous part hanging forward into the nostril. It readily breaks under the pressure of the forceps, is void of sensibility, and is composed of a thin, mucous pellicle, enclosing a soft cellular substance, the cavities of which are filled with watery fluid. This species of polype seldom exists singly, and is often met with in great numbers together. One nostril is very rarely affected alone. It is most common between the age of twenty and forty, may attain a large size, and usually expands in damp, foggy weather. This variety of polype sometimes contains fibro-cartilaginous concretions, as in Fig. 128.

The *fibrous polype* is distinguished by the extreme firmness of its texture, which nearly equals that of tendon. Great effort is required to detach it: it exhibits a faintly striated arrangement, and is composed of whitish filaments agglutinated by a dense fibrinous substance. Although it sometimes grows in both nostrils, it almost always exists singly, and is most common in adults. When touched it bleeds profusely, and often acquires a very great bulk, protruding externally, descending into the fauces, and pressing upon the walls of the nasal cavities in all directions.

The third and last species of polype requiring to be noticed is the *vascular*, which, in comparison with the other two, is extremely rare. Young persons are most subject to it, and it occasionally grows to a very large size. Of a red florid color, it is soft and erectile, bleeds from very slight causes, the hemorrhage issuing from every part of its surface, and is composed essentially of vessels, some of them of considerable magnitude. It is rarely of a malignant character, and does not often return when extirpated.

Of the different species of polypes now described, the fibrous is by far the most liable to degenerate into malignant disease. When thus affected, it becomes extremely friable, bleeds profusely when injured, and often assumes the character of genuine fungus hæmatodes, encroaching without limitation upon the bones of the nose and face, and gradually but surely sapping the foundations of life. The malignant growth exudes a fetid, purulent, or bloody matter, is attended with severe pain, usually occurs late in life, and invariably returns when extirpated. Small cysts, containing a glairy, mucous fluid, are sometimes found in these polypes; and in a specimen in my possession from the nose of an elderly gentleman, there are five large tubercles, of the same nature exactly as those found in the lungs and other organs.

There is a disease of the nasal cavities, which, as it is often mistaken for polypes, requires brief notice in this place. It is observed chiefly in weakly children and in females of a relaxed constitution, and consists in an elongation of the Schneiderian membrane, produced by the effusion of serum into the subjacent cellular substance. A tumor is thus formed of a red vascular appearance, and of a soft, spongy consistence. The parts on which it grows are the turbinated bones, of which the superior is more frequently affected than the inferior. Both nostrils are sometimes involved. The tumor may exist for a long time, but is always amenable to proper treatment.

The mucous follicles of the nose, like the same structures in other situations, are liable to obstruction of their orifices, leading to the formation of *encysted tumors*. They have an irregular, bulbous shape, a light greyish color, a soft,

gelatinous consistence, and hang within the nose like so many little bladders. No pain attends these tumors ; they easily break under pressure, discharging a thin, glairy fluid, like the white of eggs, and are extremely apt to reappear after they have been removed, either at the same place, or in the parts immediately around.

II. The *maxillary sinus*, situated in the body of the upper jaw, is subject to different maladies, the most important of which, by far, is inflammation of the lining membrane, occasioned by cold, the irritation of a carious stump, or extension of disease from the nasal cavities. The anatomical characters of this lesion have not been accurately described, but it is presumable that they do not differ from similar affections in other parts of the mucous system. The purulent matter, which is often quite abundant, is of a thick, cream-like consistence, and almost always highly offensive, apparently from its long sojourn in the antrum. When the inflammation is protracted, the lining membrane becomes thickened, the natural outlet is partially or entirely closed, the dimensions of the sinus are increased, ulceration is set up, and great mischief is frequently done to the maxillary bone. The first manifestation of this malady is a dull, aching pain, which gradually augments in intensity, and at length assumes a throbbing, pulsatory character : very often it extends towards the forehead, in the direction of the frontal sinus, and in most cases it is accompanied by a sensation of weight and tightness. In a short time the cheek becomes red, hard, and full ; and, on raising the lip, the gum is found to be abnormally tumid just above the fangs of the teeth.

When the natural outlet of this cavity is shut, an immense accumulation of mucous fluid occasionally takes place, forming a tumor which exhibits all the outward features of carcinomatous disease. In this affection, the maxillary sinus is brought in the same relations as a mucous crypt laboring under an obstruction of its orifice. The normal secretion still goes on, but being unable to find an outlet, it is pent up, and thus forms a species of encysted tumor. The fluid is usually of a thick, glutinous consistence ; but may be thin and glairy, like the white of an egg, or the contents of a ranula.

Polypes, of the same nature as those of the nose, sometimes grow in the antrum. They are generally attached to the mucous membrane by a pretty broad base, and increase with more or less rapidity, until they fill the whole chamber. In time, they encroach upon the surrounding parts, as the eye, nose, mouth, and face, thrusting them out of their natural position, and thus occasioning considerable deformity. In color, they are ordinarily florid, from their excessive vascularity ; and in consistence they vary from the softness of flesh to the firmness of fibro-cartilage, cartilage, and even bone. A profuse discharge of fetid, sanious matter usually accompanies this disease, and the part is the seat of constant pain, commonly of a dull, aching character.

Another affection, which is sometimes observed in this chamber, is *carcinoma*, generally, if not invariably, of the encephaloid kind. The young appear to be most obnoxious to it, but the old are by no means exempt from it. The disease usually begins in the lining membrane, or in the submucous cellular texture ; and, as it proceeds, it invades the osseous framework of the face, leading finally to the most hideous deformity. In a case which recently fell under my observation, in a man fifty-seven years of age, the tumor, although scarcely of eleven months' standing, was of enormous size, encroaching, on the one hand, upon the roof of the mouth, and, on the other, upon the nose, eye, and forehead. The progress of this malady is generally rapid, and its result always unfavorable. When removed with the knife, it is sure, sooner or later, to reappear at the cicatrice, or in some neighboring part.

Exostoses occasionally grow in the antrum. In a specimen which I had an opportunity of examining a few years ago, there were from eight to a dozen of these excrescences, varying in volume between a mustard-seed and a grain of wheat, which they also resembled in shape. In a few rare instances, these exostoses acquire a very large magnitude, so as to fill not only the antrum, but encroach very much upon the neighboring organs. In a case recorded by Sir Astley Cooper, the bony masses projected into the orbits of the eyes, and eventually produced fatal compression of the brain.

III. It is seldom that the *frontal sinus* is the seat of disease. This cavity is lined by a reflection of the pituitary membrane of the nose, in the lesions of which it sometimes participates, especially in the catarrhal affections which are so common in this country. The inflammation occasionally terminates in the effusion of purulent matter, which usually finds a vent through the nostrils, though in a few rare instances it works its way out through the bones and soft parts, leaving a troublesome fistulous opening. When chronic, the disease is generally attended with thickening of the mucous membrane, together with a discharge of thin, fetid matter, and a diminution of the sense of smell.

It is rare that the frontal sinus contains *calcareous concretions*; nevertheless, a few such cases have been recorded by authors. A most instructive one is to be found in the first volume of the *Gazette Médicale de Paris*. It occurred in a female who had daily suffered, for several years, from an obstinate and distressing headache, which commenced in the left frontal sinus, and gradually involved the whole of the corresponding side of the cranium. Under the influence of sternutatories, three or four calculi, about the size of a small bean, were discharged from the nose, followed by a very offensive suppuration, and finally by a complete cure. On analysis, these concretions were ascertained to consist of phosphate and carbonate of lime, magnesia, slight traces of soda, oxide of iron, and animal matter.

Polypes have been found in a few instances in the frontal sinus; and Langenbeck met with a case in which it contained an enormous hydatid.

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## CHAPTER XIX.

### OF THE MOUTH, PHARYNX, AND ŒSOPHAGUS.

I. *Diseases of the Lips*.—Carcinoma, Encysted Tumors, and Congenital Fissure.—Malformations of the Jaw.—II. *Glossitis*.—Ulceration, Hypertrophy, and Cancer of the Tongue.—Congenital Deficiencies.—III. *Salivary Glands*.—Parotitis.—Atrophy and Hypertrophy.—Scirrhus.—Calcareous Concretions.—Ranula.—Fatty Degeneration.—Saliva.—Morbid Alterations—IV. *The Teeth*.—Organization, Articulation, and Chemical Constitution.—Gangrene.—Inflammation of their Internal Membrane.—Fungous Tumors.—Exostoses.—Denuding Process.—Deposits of Tartar.—Congenital Vices.—V. *The Gum*.—Liability to Inflammation.—Epulis.—Ulcerative Absorption.—Mortification.—Alveolar Abscess.—VI. *Diseases of the Tonsils*.—VII. *The Soft Palate and Uvula*.—VIII. *The Pharynx*.—Diphtheritis.—Polypes.—Sacculated Condition.—IX. *Œsophagitis*.—Ulceration.—Softening.—Stricture.—Scirrhus.—Laceration.—Congenital Malformations.

1. THE *lips* afford a subject of interest to the morbid anatomist chiefly on account of carcinoma, encysted tumors, and congenital malformations. Cancer is sufficiently common here, especially in oldish subjects, and usually begins in the follicular structure of the part, which becomes hard and thickened, and soon tends to ulcerate. The sore thus formed is often very deep, with fiery and everted edges, and gives vent to a thin, sanious, and eroding fluid. When removed by excision, the disease commonly returns. If permitted to progress,



it gradually eats away the lip, and involves the gum, together with the periosteum, and the substance of the jaw.

When the orifice of one of the labial glands becomes accidentally obstructed, mucus accumulates in it, converting it into an *encysted tumor*. The swelling seldom exceeds a hazelnut, but, in a few instances, I have found it as large as an almond. Its form is usually spherical, its appearance semi-transparent, and the fluid it contains is thick and glairy, like the white of eggs.

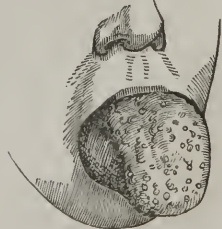
The congenital malformations of this structure are usually comprehended under the title of *hare-lip*, from their supposed resemblance to the lip of the hare. The most simple form in which it is presented is that of a fissure, extending from the border of the lip to its connection with the gum. Generally seated to one side of the mesial plane, more frequently on the left than the right, it exists either by itself, or is complicated with malformation of the jaw, palate, or nose, or of all these parts together. The margins of the abnormal cleft are more or less rounded off; and, as they are covered with mucous membrane, they are usually of a reddish color. In double hare-lip there are two such fissures, separated by an intermediate portion of lip, which varies much in size and shape, being sometimes broad and quadrangular, but more commonly narrow, elongated, and tit-like. The cleft, whether single or double, is occasionally more or less oblique. The defect, it need scarcely be observed, always depends upon an arrest of the natural development of the part concerned.

“The malformation to which the upper jaw is liable consists in a projection of the central part that holds the cutting teeth, forming a tumor from which the teeth grow out at a right angle to their ordinary direction. In most cases of this kind, the projection comprehends an equal portion of both superior maxillary bones, the portion, namely, which, in the lower animals, is occupied by two distinct pieces, the *ossa incisiva*. It forms a round knob, connected by a narrow neck to the septum of the nose, covered with a firm substance, similar to the gum, and having at its anterior part a similar shaped but smaller sized appendage, which seems to consist of the tissue that should have constituted the lip. The fissures on each side of this knob meet together behind it, and are there continued single through the palate backwards. Instead of this conformation there is sometimes merely an overlapping of one edge of the split gum over the other, and the degree to which the projection thus formed takes place is extremely various.”

II. The *tongue* is liable to be affected with inflammation, suppuration, ulceration, hypertrophy, cysts, and cancer.

*Glossitis* may exist as an idiopathic affection, but is most generally induced by salivation, by mechanical injury, or corrosive substances. The organ is extremely painful, and may swell so enormously as to threaten the patient with suffocation: all its vessels are engorged with blood; the papillæ are greatly enlarged, and its surface, at first of a bright red, is soon coated with viscid mucus, or, when the inflammation run high, even with a layer of lymph. (Fig. 129, A.) Now and then the disease is limited to one half of the tongue, the raphe forming a pretty distinct line of demarcation between it and the unaffected side. Glossitis may terminate in resolution, in suppuration, or in gangrene. The disposition to disappear is sometimes manifested as early as the third day, but mostly not until about the sixth. When matter forms it is generally deep-seated, and requires free incisions for its evacuation. The termination of glossitis in gangrene is extremely rare,

Fig. 129 (A).



and is noticed chiefly in persons of a debauched habit and worn-out constitution.

The mucous membrane of the tongue and cheek is liable to several forms of *ulceration*. In psoriasis there are whitish excoriated patches, not unfrequently half an inch in diameter; and in children nothing is more common than to see these parts studded with small milky-looking vesicles. These blebs, which are technically called *aphthæ*, are of an irregularly spherical figure, and vary in size from a pin's head to a small pea. When punctured, their contents are found to consist of two parts, one of a fibrous, the other of a serous nature. *Aphthæ* are frequently connected with gastro-enteric irritation; and there is reason to believe that they often extend through the œsophagus, as far as the cardiac extremity of the stomach. In several instances, however, in which I made a careful inspection with a view of ascertaining this point, I failed in tracing the vesicles beyond the fauces, although the tongue, the inside of the cheeks, and the roof of the mouth were literally covered with them.

Flat, shallow ulcers, with hard and thickened edges, are occasionally observed on the tongue, cheeks, and fauces, in secondary syphilis, and in persons who have been excessively salivated. The parts are foul and clammy; the saliva acrid and abundant; the gums spongy, and disposed to ulcerate.

The tongue being composed of different structures, *hypertrophy* may be limited to its muscular substance, to its mucous covering, or to its papillæ. The former variety, although sometimes congenital, commonly appears soon after birth, and is now and then witnessed in adults, either without any assignable cause, or as the result of glossitis. Of this nature, seem to have been the case published by Dr. Harris, of Philadelphia, of a girl twenty-four years of age. Commencing when she was quite young, the intumescence was attended, at first, with great pain and difficulty of deglutition, and gradually progressed, until the organ protruded four inches beyond the incisor teeth, measuring one inch and three-fourths in thickness, by six inches and three-fourths in circumference. The projecting portion was extremely dense, of a dark chocolate color, and constantly covered with a thick, tenacious mucus. The part within the mouth was entirely free from disease, excepting the lenticular papillæ, which were about five times the natural size.\* In another case, recently reported by the same distinguished surgeon, the hypertrophy was congenital, and was attended with unusual shortness of the branches of the lower-jaw, with great separation of the incisor teeth.† Hoffmann, an old physician of Stockholm, removed a tongue of this kind from a girl, ten years old, which protruded four inches, and was two inches thick.‡ An interesting case, of a similar description, but where the swelling was considerably less, is recorded by Dr. Wells, in the *Western Journal of the Medical and Physical Sciences* for July, 1832. The patient, likewise a girl, was six years of age, and had formerly suffered much from inflammation and ulceration of the mucous membrane of the tongue. The organ, preternaturally dense and rigid, hung down two inches and a half beyond the teeth of the upper-jaw, being a little more than two inches in breadth. This lesion, like that next to be mentioned, is generally caused by inflammatory irritation; and, upon a careful examination of the principal cases of it on record, I am disposed to believe that it is much more frequent in the female than in the male. Enlargements of this kind are sometimes remarkably vascular, being pervaded by plexuses of dilated vessels, and subject to temporary erections, from the preternatural influx of blood. Dissection shows that the fleshy fibres of the tongue have

\* *American Journal of the Medical Sciences*, vol. vii., p. 17.

† *Op. cit.*, vol. xx., p. 15.

‡ *Acta Literaria et Scient. Sueciæ*. 1732, t. iii.

lost their normal color, and that they are converted into a dense semi-cartilaginous substance, with scarcely a trace of the primitive structure.

With respect to the *mucous membrane*, the hypertrophy, as might be expected, is usually limited to one or more points, though, in a few instances, it has been known to extend over the entire organ. The affected part varies in thickness from the twelfth to the third of an inch, and exhibits a rough, greyish appearance, the prominence being occasionally divided by deep fissures. The enlargement has little or no pain in it, and the sense of taste is almost always partially destroyed.

The *papillæ*, situated on the dorsal surface of the tongue, have a narrow base, and a broad, mushroom-like head. From a deranged state of the stomach, or from local injury, they are capable of becoming considerably enlarged, so as to form preternatural tumors, of a deep florid color, which may be mistaken for cancerous excrescences. From these, however, they are readily distinguished by there being no real ulceration of the tongue, and by the absence of any decided pain. The size which such tumors may acquire varies from that of a pea to that of a nutmeg.

Still more rare than the lesion just described is *atrophy* of the tongue. This is generally associated with inflammatory irritation, and may reach such a height as to leave behind it nothing but a dense, whitish mass, with scarcely a vestige of muscular tissue.

A singular disease of the tongue, first noticed, I believe, by Mr. Earle, of London, is occasionally met with. It consists of very minute semi-transparent *vesicles*, occupying the muscular substance of the organ, the mucous membrane of which they not unfrequently elevate in the form of little tumors. The precise nature of these vesicles is not well understood. In the case mentioned by Mr. Earle, they grew in clusters, and were so sensitive as to bleed profusely on the slightest injury. The clusters, in some places, were separated by deep clefts, which discharged a fetid, irritating sanies.

This organ is not unfrequently the seat of *cancer*, a disease which, though most common in old persons, is sometimes observed in the young. It commences in the form of a hard, inelastic, puckered tubercle, situated towards the anterior part of the tongue, by the side of the mesial plane. The ulcer which follows is excavated, foul, and uneven; the edges are thick and contracted; the base and surrounding substance hard and gristly. In time, the disease affects the gums and cheeks, and the erosion thus produced often presents a frightful aspect. The breath is intolerably fetid; the patient is harassed with lancinating pain; the neighboring lymphatic ganglions swell; and profuse hemorrhages supervene from the ulceration of one or more vessels. In some instances, the disease begins in a fungous excrescence, at the side of the tongue, which extends rapidly over the surface, and assumes all the characters of encephaloid. In whatever manner it may appear, there is reason to believe that carcinoma is originally located in the follicular structures, from which it gradually spreads to the other tissues.

The tongue, finally, is liable to congenital *malformations*. Thus, it may be bifurcated at the tip, as in the snake and the lizard; be extremely small, and nipple-shaped, as in parrots; be double, or even entirely absent. The frænum is sometimes too long, or too short, or unusually thick, and of a dense, fibro-cartilaginous consistence.

III. The *salivary glands*, situated to the number of three on each side of the jaw, although differing in size and shape, all agree in being of a pale ochrey color, not unlike the cineritious substance of the brain, and in being composed of minute granules, aggregated into lobules and lobes, and connected together



by firm, cellular tissue. They are provided each with an excretory duct, by which the fluid they secrete is poured into the mouth; none of them, however, have a proper envelope, and hence the reason, perhaps, why they are so little subject to disease.

All the salivary glands are not equally liable to morbid alterations. The parotid is infinitely more frequently affected than the others, and the disease to which it is most subject is *mumps*, an infectious, inflammatory complaint, occurring sometimes endemically. Both organs are usually involved. The swelling, which is often considerable, reaches its height about the end of the fourth day; after which it gradually subsides, and in a week from the time of the invasion is entirely gone. One of the most singular features of the disorder is its liability to be translated to other organs, as the testicle in the male sex, and the breast in females. It rarely occurs more than once, and youth is its favorite period of attack.

In whatever way induced, the anatomical characters of the disease are generally the same; that is to say, the substance of the affected gland is preternaturally red, its density is augmented, its lobules are rendered more distinct, and the connecting cellular tissue is infiltrated with serosity. In severe cases, fibrin and blood are effused, giving the part a bloodshot appearance. Added to these phenomena, the capillary vessels, both arterial and venous, are excessively engorged, and the minute excretory ducts are so much compressed, as to be no longer permeable to the most diffusible injecting matter. The salivary fluid is also more or less altered. When the inflammation is at its height, the secretion is either very much diminished, or else entirely suspended: by degrees it is restored, and is then often discharged in immense quantities, as is exemplified in mercurial salivation. In this affection, which appears to be propagated from the gums and cheeks, as there are always manifestations of it there, before it involves the glandular structures about the jaws, the salivary fluid is remarkably thin, pellucid, and of a strong, disagreeable taste. Much of this is owing, doubtless, to the follicular secretion of the mouth, which, under such circumstances, is poured forth in great abundance, and of a very fetid quality.

Parotitis, under favorable circumstances, may terminate in *suppuration*. Of this I have witnessed a considerable number of cases, in two of which an opportunity was afforded me of making an autopsic inspection. In one of them both glands were considerably enlarged, unnaturally dense, of a greyish, gristly appearance, and pervaded throughout by purulent matter, collected here and there into little abscesses, the largest of which did not exceed the volume of a hazelnut. The pus was white, thick, and tenacious, like that of a scrofulous lymphatic ganglion. The weight of the right parotid was one ounce two drachms; of the left, one ounce one drachm. The glandular substance was very little injected, a small straggling vessel being only here and there perceptible. The patient was sixty-eight years of age, and died of disease of the liver and the duodenum, for which he was attended by my friends, Drs. Drake and Rives. The parotitis came on ten days before death; and ran its course without the slightest pain.

In the other case, the glands were also very much enlarged; the connecting cellular tissue was remarkably congested and even ecchymotic; the matter, which was of a pale yellowish color, was contained in an immense number of little abscesses, not larger than a mustard-seed, and evidently seated in the rootlets of the stonion ducts. The patient, a man about thirty-two years of age, died of bilious fever, and had been salivated.

*Gangrene* has been known to seize on the parotid, and to proceed until it

had entirely destroyed its substance. This termination, however, is extremely rare, and is observed chiefly in cases in which the surrounding textures are extensively involved by the inflammation.

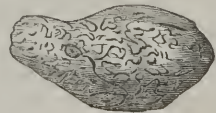
The salivary glands, especially the parotid, are subject to *atrophy*. This is usually induced by some morbid growth in their immediate vicinity, which, by causing the absorption of their substance in proportion to its own enlargement, at length usurps their place. *Hypertrophy*, an affection much more common than the one just adverted to, is generally associated with induration, the effect of which is to render the glandular structure hard, dense, and sometimes almost of a gristly consistence.

True *scirrhus* is occasionally met with in the parotid, as are also encephaloid and melanosis. The occurrence, however, of these malignant growths is rare in this country, and is seldom witnessed, except in persons passed the prime of life. The size of the organ, in these affections, is sometimes really surprising. In a case in which it was removed by Dr. Prieger, of Germany, on account of a carcinomatous disease, it weighed two pounds and three-quarters. The patient was a female, thirty-five years of age. Tubercles, I believe, have never been observed either in this or in the other salivary glands.

I am not aware that authors have recorded any examples of the *fatty degeneration* of the salivary glands; but an interesting case of this kind has recently fallen under my own observation, in a man forty-two years of age. The disease involved the right parotid, which was enlarged to nearly three times the normal bulk, and had been gradually coming on for several years, unattended with pain or tenderness on pressure. After the extirpation of the organ, which was successfully accomplished by my friend and former colleague, Professor Parker, it was found to be completely transformed into adipous matter, quite greasy to the touch, remarkably friable, and of a pale bluish color, not unlike the buffy coat of the blood. The granular texture was still recognizable, but the connecting cellular tissue appeared to be entirely destroyed. When pressed between the fingers, a clear oily fluid oozed out, and which, when the gland had remained some time in alcohol, collected in considerable quantity on the surface of that liquor. A similar transformation, as will be shown hereafter, is occasionally witnessed in the pancreas, which bears so close a resemblance to the parotid, that it has been described by many under the name of the salivary gland of the abdomen. Whether the sublingual and submaxillary are susceptible of a like change, I am not able to say, as there are no cases of it on record.

The ducts, both of the parotid and submaxillary glands, are sometimes the seat of calcareous concretions, which are named *salivary calculi*. Their volume varies from that of a cloverseed to that of a large almond: their number is usually small. They are of a pale yellowish color, oval in their shape, and have a finely tuberculated surface. Their composition is phosphate and carbonate of lime, agglutinated together by a small quantity of animal matter. A concretion of this description from the left submaxillary gland of a patient of Dr. T. L. Caldwell, of this city, is seen in Fig. 129 (B). It is represented of the natural size and shape.

Fig. 129 (B).



The principal disease of the sublingual gland is *ranula*, which is generally supposed to depend upon the dilatation of one of its ducts, but is in reality an encysted tumor. The swelling is usually occupied by a thick, glairy fluid, like the white of eggs, but sometimes is watery, or of a pultaceous consistence:

occasionally, it resembles the synovial liquor of the joints, and contains particles of gritty matter, probably a mixture of phosphate and carbonate of lime. The size of the tumor varies from that of a pea to that of the fist; its form is irregularly oval, and its parietes are thin, and for the most part translucent. The submaxillary gland is sometimes similarly affected.

The *saliva*, the product of the glands, the diseases of which we have just been considering, is a transparent fluid like water, but much more viscid, without taste or smell, and of the specific gravity of 1·0061—1·0088. It is slightly alkaline but not acid, and consists of a peculiar body, termed *ptyaline*, in union with *osmazome*, admixture of *mucus*, *sulpho-cyanogen*, and earthy salts. The latter are, according to Mitscherlich:

Chloride of potassium	-	-	-	-	0·18
Potash, combined with lactic acid	-	-	-	-	0·094
Soda	-	-	-	-	0·024
Lactic acid	-	-	-	-	
Soda, probably combined with mucus	-	-	-	-	0·164
Phosphate of lime	-	-	-	-	0·017
Silicic earth	-	-	-	-	0·015

The quantity of this fluid varies. Mitscherlich found that in a healthy man, affected with fistula of the stenonian ducts, the amount furnished by the corresponding parotid in twenty-four hours was from two to three ounces, troy: the saliva collected from the mouth during the same period, and derived from the five other glands, amounted to six times more. The probability is that this quantity, as a general estimate, is too high.

The salivary, like the other secretions, is liable to various morbid alterations. Thus, it may be diminished or increased in quantity, puriform or bloody, acid or highly alkaline, saline, calcareous, or fetid. In certain diseases, as in fevers and inflammations, the salivary secretion is sometimes nearly entirely suspended, the mouth is dry, and the thirst more or less urgent. In nervous affections, on the other hand, it is often very much augmented, as well as remarkably changed in its properties. In hydrophobia it is poisonous, and capable of communicating the same disease.

The morbid alterations of the saliva have been ably investigated by Dr. Wright of Birmingham, whose account of them, inserted in the *London Lancet*, is by far the most precise that has yet been published, and leaves me no other task than that of brief analysis.

*Puriform saliva* is of greater density and opacity than the healthy secretion; it contains more albumen than natural; is always alkaline; seldom deficient in sulpho-cyanogen or ptyaline; easy of decomposition, and possessed of feeble digestive properties. There is little frothiness or flocculence; and on the application of heat, the pus-globules, which are regularly distributed through the fluid, perform a series of revolutions round their own axes. This variety of secretion is usually consequent upon inflammation of the salivary glands, or of some of the contiguous structures, and often occurs in severe ptyalism, parotitis, tonsillitis, painful dentition, ear-ache, and other kindred affections.

The saliva is sometimes *bloody*. Its color, which is perfectly uniform, varies from a bright red to a deep brown or black; it has a mucous odor, but no taste, is free from frothiness, is specifically heavier than in the healthy state, and exhibits neither flocculi nor coagula, except in consequence of decomposition, boiling, or the action of chemical reagents. Bloody saliva is invariably characteristic of debility, either general or local; it is most common in dysentery,



small-pox, typhus, and plague, and is then always a fatal symptom. It is also sometimes observed in scurvy, phthisis, chlorosis, pancreatic disease, and in weakness arising from excesses, or deficient nutrition.

A *sour* state of this fluid is mentioned by various authors. The acids with which it is liable to be contaminated are the lactic, acetic, muriatic, uric, and oxalic. It reddens litmus-paper, and has often a sour odor. In a case related by Prout, the breath of the patient smelt strongly of vinegar. The specific gravity ranges about the same as in the healthy state. When secreted in large quantity it is obscured throughout by films and flocculi. It generally contains more mucus and less sulpho-cyanogen than usual. "The saliva is impregnated with lactic acid chiefly in gout, rheumatism, ague, diabetes, and gastro-enteritis; with acetic acid in aphtha, scrofula, scurvy, small-pox, protracted indigestion, and after the use of acescent wines; with muriatic acid in simple gastric derangement from immoderate or improper animal food; and with uric acid in arthritic affections. When oxalic acid exists in the saliva, its presence will most likely be dependent upon depraved digestion or imperfect assimilation." In disorders of the stomach and bowels, both Wright and Donné have almost always found the saliva acid.

The *alkali*, naturally existing in the saliva, is liable to temporary increase. The fluid, when thus affected, has a mucous smell, and always contains an excess of albumen, in consequence of which it is rendered unnaturally opaque by the application of heat. The quantity of alkali may be twice as great as usual, and when this is the case there is generally a proportionate diminution of sulpho-cyanogen and saline constituents. The saliva which contains an excess of this substance is always to be regarded as indicative of local or general nervous excitement. Occasionally, though rarely, the undue alkalinity is attributable to the presence of ammonia. The secretion, in this case, has a dingy aspect, and is clouded with films and flocculi. It has a very strong alkaline reaction, and either an ammoniacal or a disagreeable mucous smell. Sulpho-cyanogen is wanting, and the fluid is secreted more sparingly than usual. This variety of saliva, most common in putrid fever and scurvy, is eminently indicative of a cachectic and depraved state of the system.

There are three causes to which an unduly *saline* state of the saliva is referrible; first, an increased quantity of muriate of soda in the blood; secondly, idiopathic disorders of the salivary glands; and lastly, derangement of the digestive apparatus. In the first and second of these cases the fluid differs from the healthy secretion only in containing an excess of a natural constituent; in the third, the saliva is generally more or less vitiated, offensive to the taste and smell, opaque, or dingy-looking, deficient in ptyaline and sulpho-cyanogen, and easily decomposed, and possessing little digestive activity. This variety of fluid is most common in persons who use large quantities of salt; but it may also be produced by idiopathic disorder of the salivary glands, and by functional derangement of the digestive organs.

*Calcareous* saliva, in a mild degree, is not uncommon; in fact, with some people, it is almost habitual. It is generally attended with symptoms of dyspepsia, and sometimes exists in large quantities. It is opaque, slightly frothy, and white, like milk: under the microscope it has a curdy appearance. When the proportion of lime is considerable, the fluid, in a few hours, deposits a heavy white precipitate, and the supernatant fluid is left in a state of semi-transparency. Calcareous saliva decomposes very slowly, and is acid, alkaline, or neutral, according as there is a predominance of phosphate or carbonate of lime. Ptyaline and sulpho-cyanogen usually exist in due quantity. The earthy matter is often deposited upon the teeth, as an incrustation known by

the name of *tartar* ; it may also obstruct the orifices of the salivary ducts, or collect in the substance of the glands, in the form of concretions.

Finally, the saliva may be *fetid*. This may be owing to disorder of the general system, or of one or more of the salivary glands ; it may also arise from the use of putrescent or strongly scented food. Musk, assafœtida, copaiba, turpentine, camphor, and the essential oils, whether administered by the mouth or the rectum, or directly injected into the bloodvessels, not only impart their peculiar odor to the saliva, but may be separated from it in an unaltered form by the ordinary processes of analysis.

Saliva, which is fetid from a disordered state of the system, or of the salivary glands, is always turbid and flocculent : of variable color, but generally red, brownish, green, yellow, or dingy ; greasy to the touch, viscid, alkaline or acid ; of a putrid or cheesy odor ; and of a musty, or nauseous bitter taste. It is deficient in ptyaline and sulpho-cyanogen, and usually secreted rather sparingly. The pathological condition of this form of saliva seems to be a local depravity of the nervous function.

IV. Although the *teeth* bear a very striking resemblance to the bones, yet as they differ from them essentially in their mode of development, and the uses which they subserve in the economy, to say nothing of the peculiarity of some of their diseases, it will be necessary to consider them separately. To enter minutely upon this matter would be foreign to the design of this treatise, and I shall therefore, after making a few remarks concerning the structure and composition of these organs, content myself with a very rapid outline of their more interesting lesions.

The total number of teeth in the adult is thirty-two, of which eight are named incisors, four cuspid, eight bicuspid, and the remaining twelve molar. Although these four classes are arranged in perfect uniformity in each jaw, yet they differ widely from each other in size and form, as well as in their use and articulation. Anatomically considered, each tooth has a body, a neck, and a root ; the first, which is also called the crown, being the part which is incrustated with enamel ; the second, that which is embraced by the gum ; and the third, that which is implanted into the substance of the jaw.

In the interior of every tooth is a canal, which represents very faithfully its outward form, being larger in the crown than in the root or fang, at the extremity of which it terminates in a minute foramen. The whole of this cavity is lined by a very delicate membrane, which is highly vascular and exquisitely sensitive, and which is intimately connected with the growth and preservation of the organ, into the composition of which it enters. The vessels and nerves penetrate the aperture at the bottom of the fang, and ramify over this membrane in every direction ; but whether any branches are spent upon the substance of the tooth, is still a mooted point. After a successful injection with size and vermilion, neither the enamel nor the bony part appears to be reddened. Nevertheless, it is not only highly probable, but almost certain, that these structures are organized ; otherwise it would be difficult, if not impossible, to explain the sympathetic connections between them and the rest of the system, and the various changes which they experience in consequence of disease. Their vitality, however, is no doubt of a very low grade ; and hence they readily yield to such agents as have a tendency to destroy them.

The nerves of the teeth are derived from the ganglionic portion of the fifth pair, filaments of which may be traced through the cavity of the fang into the substance of the lining membrane. The arteries, which are accompanied by corresponding veins, are furnished by the internal maxillary branch of the external carotid. The existence of absorbents has been ably controverted by Mr.

John Hunter, but not successfully, as there is every reason to believe that these vessels exist here as in other parts of the body, though doubtless in less abundance.

The mode of articulation by which a tooth is fixed in its socket, is termed gomphosis. The fang, however, through the intervention by which this is effected, does not lie in immediate contact with the walls of the containing cell, but is separated from them by a very delicate vascular membrane. This is merely a prolongation of the periosteum of the maxillary bones, which, after covering the alveolar processes, dips down into each socket, the parietes of which it lines. From the bottom of the cavity it is reflected over the root of the tooth, which it entirely invests as far as the neck, at which part it is intimately united with the gum. Thus, the membrane here spoken of not only adds materially to the firmness of this articulation, but it may be said to answer to the osseous portion of the organ which it covers the same purpose that the periosteum does to the bones of the skeleton, preserving its connection, and contributing to its support.

Two distinct substances enter into the formation of the teeth, differing widely from each other in their structure, as well as in their chemical composition. The first, of which the mass of the organ mainly consists, is of an osseous nature, extremely hard, compact, and indestructible; it is of a dull yellowish color, and is made up of a cartilaginous framework, the cells of which are occupied by earthy matter, upon which the solidity of the teeth essentially depends. The chemical composition of the bony substance, as ascertained by Berzelius, is as follows:

Animal matter	-	-	-	-	-	28.
Phosphate of lime	-	-	-	-	-	62.
Fluate of lime	-	-	-	-	-	2.
Carbonate of lime	-	-	-	-	-	5.5
Phosphate of magnesia	-	-	-	-	-	1.
Soda, with muriate of soda	-	-	-	-	-	1.5
						<hr/>
						100.0

The enamel covers the crown of the teeth, forming an incrustation for it, the thickness of which varies in different parts of its extent. In the grinders it is always more abundant on the triturating surface than at the sides, the reverse being the case in regard to the front teeth. As it approaches the neck, it becomes gradually thinner, and finally terminates almost imperceptibly. The enamel is the hardest animal substance with which we are acquainted: it is of a pale milky color, semi-transparent, and glistening, and consists of minute fibrous crystals, disposed in a radiated direction in regard to the centre of the organ to which it is attached. This arrangement is very obvious when the enamel is broken. The following is the result given by the celebrated chemist above mentioned, whose analysis appears to have been more elaborate than that of any other experimentalist:

Animal matter	-	-	-	-	-	1.
Soda, with muriate of soda	-	-	-	-	-	1.
Phosphate of lime	-	-	-	-	-	85.3
Fluate of lime	-	-	-	-	-	3.2
Carbonate of lime	-	-	-	-	-	8.
Phosphate of magnesia	-	-	-	-	-	1.5
						<hr/>
						100.0



When a tooth is steeped in diluted muriatic acid, it becomes flexible, but retains its form: the earthy matter is dissolved, and leaves the animal substance with which it was incorporated.

Although a tooth is not sensibly vascular, yet, if it be taken from the jaw of a living person, and immediately replaced in its former socket, it will contract adhesions to the raw surface, and be permanently retained. The singular experiment of Mr. Hunter is well known. This ingenious physiologist transferred a tooth from its cavity into an incision, made on purpose, in the comb of a cock, to which it became so firmly united that, on killing the animal some time subsequently, and injecting its head, the fluid ran freely into the internal membrane of the transplanted organ. No better proof, surely, could be offered, of the vitality of a structure, than the result of such an experiment. If the same operation be performed with a tooth that has been some time drawn, it acts as an extraneous substance, and the socket makes an effort to throw it off.

The most common disease of the teeth by far is *gangrene*, a lesion which is strictly analogous to necrosis of the osseous tissue. Commencing invariably in the bony substance of the crown immediately under the enamel, it presents at first the appearance of a minute, opaque, brownish speck, which gradually extends towards the centre of the organ, assuming at length a blackish color, and becoming so soft and brittle as to be crushed on the slightest touch. Thus a large cavity is exposed, which perhaps had not previously been suspected to exist. Advancing in the manner here described, the gangrene frequently destroys the entire crown, or converts it into a dark, pulverulent substance, without a single trace of its primitive texture. The roots are usually the last to die, and it often happens that they retain their vitality long after the other parts have fallen into complete decay. Deprived of life, they act as extraneous bodies, exciting ulcerative absorption of the gum and alveolar processes, whereby they lose their connection, and are finally dislodged.

The teeth most liable to this disease are the last grinders, probably from some defect inherent in their constitution in consequence of their late development. The upper central incisors are also frequently affected; and so likewise the first molar teeth, particular those of the under jaw. The lower incisors, on the contrary, are rarely attacked. Every part of the crown appears to be equally liable to gangrene; and it sometimes happens, though this is infrequent, that the disease begins at several points simultaneously. Generally tardy in its progress, there is at first seldom any pain or even uneasiness; by and by, however, when the internal cavity is laid open, the lining membrane becomes exceedingly tender, and productive of excruciating suffering, which is either continuous, paroxysmal, or remitting. The proximate cause of dental gangrene is inflammation.

Persons of a tubercular constitution are very subject to this species of decay, which often sets in at a very early period of life, and proceeds until nearly every tooth is destroyed by it. The upper incisors of children are frequently attacked in this way within a short time after their appearance, and occasionally, indeed, when they are still partially covered by the gum. There would likewise seem to be a hereditary proclivity to this disorder. "It often happens," says Mr. Bell, in his admirable work on the Anatomy, Physiology, and Diseases of the Teeth, "that this tendency exists either in the whole, or great part of a family of children, where one of the parents had been similarly affected; and this is true to so great an extent, that I have very commonly seen the same tooth, and even the same part of the tooth, affected in several individuals of the family, and at about the same age."

The internal membrane of the teeth is occasionally affected with *inflam-*

tion, the other anatomical elements of these organs being apparently in a sound state. The disease, as might be anticipated from the confined situation of this delicate structure, is generally accompanied with the most excruciating pain, of a throbbing, pulsatile nature, and, if allowed to go on, almost always leads to the formation of an alveolar abscess. In other cases, there is a pretty abundant deposit of fibrin, both within the canal of the affected organ and around its roots, the latter of which exhibit a singularly shreddy aspect, the plastic lymph hanging from the thickened periosteum in all directions. Occasionally, again, though this is not very common, purulent matter is poured out, forming an abscess analogous to what is sometimes observed in the interior of a bone. When the quantity of fluid is considerable, it is very apt, from its confined situation, and consequent pressure, to produce mortification of the lining membrane, with absorption of the parietes of the cavity. By this means the pus gradually escapes at the extremity of the fang, the foramen of which is much enlarged. Ulcerative inflammation is next set up in the alveolar process and gum, which continues its ravages until the enclosed matter, now extremely offensive, obtains an outlet, the affected tooth meanwhile losing its vitality, and presenting a dull yellowish, dark, or brownish color.

The exposure of the internal membrane from gangrene, fracture, or other causes, not unfrequently leads to the formation of fungous tumors, varying in volume between that of a pin-head and an ordinary pea. Of a pale reddish color, they are of a soft, fleshy consistence, and are essentially composed of a plexus of vessels, connected together by delicate cellular substance, and traversed by minute nervous filaments. From their excessive vascularity, these growths are liable to bleed upon the slightest touch; and although they are occasionally as insensible as healthy gum, yet in the majority of cases they are the seat of the most exquisite pain. The period required for their development varies from a few months to several years; but, from the great suffering which they induce, they are seldom permitted to remain for any length of time. They appear to arise, for the most part, from the lining membrane of the fang, from which they proceed more or less rapidly until they fill the whole cavity of the organ. Occasionally, there is reason to believe that these growths spring directly from the dental nerve, which becomes exceedingly vascular, elongated, and thickened. The teeth most frequently affected with this disease, are the central incisors and the large grinders. In the case of a young lady observed by Dr. Hullehén,\* of Virginia, there were two fungous tumors of this kind, which were the seat for several months of periodical hemorrhage, vicarious, as was supposed, of the menstrual flux.

When we consider that, with the exception of the enamel, the teeth are essentially composed of the same anatomical elements as the bones, it is not surprising that they should be the seat of *exostosis*. The substance which is thus added differs from the pre-existing structure principally in being of a denser consistence, and in presenting a yellowish transparent aspect, not unlike chalcedony. The deposit ordinarily takes place at the root of the organ, but in some instances it affects the body, and may even extend as high up as the crown. Analogy would lead us to infer that the new matter is furnished exclusively by the vessels of the periosteum; and this doubtless happens in the generality of instances. The progress of this disease is usually very tardy, a long time elapsing before the bony tumor obtains much bulk.

\* Western Journal of the Medical and Physical Sciences, No. 38, p. 558.

There is a singular affection of the teeth, which has been described by Mr. Hunter under the name of "the denuding process," and the precise nature of which is still unexplained. It consists in the gradual removal of the enamel, generally without the slightest discoloration or any diseased appearance. I have most frequently observed it in the incisors, especially the inferior, but it occasionally attacks the whole dental arch. As the denuding process advances, the crown of the tooth is slowly worn away, the enamel first disappearing at the top, and subsequently at the sides, until the greater part is removed. The organ in the meanwhile changes its color, gradually becoming more yellow, and finally, when the enamel is completely destroyed, assuming a brownish aspect. The most curious circumstance in the history of this lesion is the beautiful provision by which the cavity of the tooth is protected from exposure. This consists in a deposit of new bony matter, perfectly hard and solid, but so transparent that nothing but the closest examination could detect it. Thus a sort of permanent plug is formed, which effectually protects the delicate structures within, and which exactly resembles the transparent layers of an ægose pebble, surrounded by a more opaque mass. In what this lesion essentially consists it is not easy to determine, though it is not improbable, I think, that it depends upon some original or acquired defect of the enamel, whereby it is made to yield more readily to the mechanical attrition to which the teeth are constantly subjected. It is witnessed at nearly every period of life, but is most common by far in old people.

The teeth, from want of cleanliness, as well as other causes, are very apt to become the seat of *calcareous concretions*. When first deposited this substance possesses the character of a soft, friable, porous paste, which by degrees acquires the consistence of hardened mortar, and often scales off in large masses, having the shape of the organ around which it was formed. Its usual color is a dull whitish yellow, though in some cases it is dark brown, blackish, or even greenish. The specific gravity of this matter is 1·571. From the analysis of Pepys it would appear to be composed principally of phosphate of lime, in association with a small quantity of cartilage and fatty substance. This matter has also been examined by Berzelius, who states its composition to be as follows :

Salivary matter	-	-	-	-	1·0
Salivary mucus	-	-	-	-	12·5
Earthly phosphates	-	-	-	-	79·0
Animal matter dissolved by muriatic acid	-	-	-	-	7·5

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100·0

The accumulation of this substance often takes place with great rapidity, so that in a short time the dental arches are almost completely incrustated with it. Calculous and gouty persons are particularly liable to it; and it is also frequently witnessed in lying-in females. It is ordinarily deposited, at first, around the necks of the teeth, just beneath the free margin of the gum. As it increases in quantity it produces the most disastrous effects, exciting irritation in the soft parts, which leads to absorption of the gum and alveolar processes, until the teeth, deprived of their support, are loosened and at length drop out.

Various notions have been entertained respecting the source of this substance. Some believe that it is derived directly from the mucous secretions of the mouth, vitiated by chronic irritation; but the more plausible opinion is, that it is furnished solely by the salivary glands, and that it is held in solution



by the fluid which it is the office of these organs to elaborate. This view of the subject is not only supported by the analogy which obtains in the formation of urinary calculi, but by the fact that this substance is always deposited in greatest abundance upon the superior grinders and the inferior incisors; teeth which lie in the immediate vicinity of the mouths of the salivary ducts, and by the circumstance, moreover, that it is composed of the same elements as the fluid just referred to.

The teeth experience important changes in consequence of age. As we advance in life they gradually lose their whiteness, and assume a peculiar yellowish tint, which is often remarkably conspicuous in old people. They become likewise more brittle, and the enamel exhibits an irregularly abraded appearance. These changes are produced by certain alterations which take place in the anatomical constitution of the teeth, from the obliteration of many of their vessels, followed by a diminished supply of blood.

The temporary teeth, which are only twenty in number, are surrounded each by a membranous cyst, which often inflames during dentition, and thus gives rise not only to much local uneasiness, but occasionally to great disturbance in other organs, especially the stomach and bowels. The gum at the same time becomes red and tumid, and there is generally an inordinate secretion of salivary fluid. When the tooth is fully formed, the sac is no longer of any use, and is therefore gradually absorbed.

Lastly, the teeth are liable to certain congenital vices in regard to their development, situation, and direction. In persons affected with hare-lip and cleft palate, the upper incisors are almost always badly formed, and thrust out of their natural position. Instances also occur in which some of these organs are firmly united together by osseous matter; and Albinus has related a case where the crown of the eye-tooth was turned towards the maxillary sinus, the situation of the fang being reversed.

V. Another structure which requires mention here is the *gum*. This substance, after having covered the alveolar processes of the maxillary bones, to which it adheres with great firmness, encircles the necks of the teeth, forming a partition between every two adjoining organs, which extends up as high as the enamel. In its texture the gum is somewhat peculiar, less hard and dense than cartilage, but more so than the other parts of the mucous membrane of the mouth, of which it is essentially constituted. No follicles are discoverable in it, though it is highly probable, I think, that they exist here as elsewhere. This substance is highly vascular, and of a beautiful vermilion color: it possesses very little sensibility in the normal state, but becomes extremely painful and irritable when inflamed. In old age, when the teeth fall out, it parts with its florid complexion, and acquires the density of cartilage, compensating, in some degree, for the loss of the dental arches.

Of the occurrence of ordinary inflammatory affections to which the gum, in common with the rest of the mucous system, is liable, it is not my intention here to speak; but there are several lesions which are either peculiar to this situation, or are produced by irritation of diseased teeth, of which it will be necessary to treat with some degree of minuteness.

One of the most formidable diseases of the gum, though fortunately not a very common one, is *epulis*, as it is termed, which generally presents itself in the form of a small wart-like excrescence, of a reddish color, and of a hard, gristly consistence. Its growth is seldom rapid, nor is it attended, at first, with any decided pain or inconvenience. After having remained for some time, it loses its solid feel, becomes soft and spongy, bleeds upon the slightest touch, and throws out an abundance of irregular cauliflower-like processes.

Ulceration now commences, the morbid mass rapidly augments in volume, and there is a constant discharge of fetid, purulent matter. At this stage of the disease, the gum has a remarkably red and spongy aspect, the teeth drop from their sockets, and the lymphatic ganglions in the neighborhood are more or less contaminated; the pain is also very great, and the system labors under hectic. If the tumor be excised, it almost invariably returns, especially if a part be left behind, and requires a fresh operation. Epulis never occurs in those situations of the gum from which the teeth are perfectly removed; nor is it usual to see it without some disease of these organs, or of the sockets in which they are contained. Its most frequent though not constant seat is on the transverse process of the gum, between the teeth.

Epulis is merely a species of local hypertrophy, varying in volume between that of a pea and an egg. It is invested by a prolongation of the mucous membrane of the gum, and is intersected by fibrous filaments, which add much to its density and cohesive power. Vessels enter it at every point, and, in some cases, the tumor appears to be almost entirely made up of them. Besides these anatomical elements, which constantly exist, there is occasionally, in the truly malignant form of the disease, a deposition of encephaloid matter.

The most frequent lesion of the gum is *ulcerative absorption*, produced by the accumulation of tartar around the necks of the teeth. The pressure that is thus exerted, excites inflammatory action, leading to great thickening, sponginess, and discoloration of the gum, with erosion of its substance. In this way the teeth are entirely denuded at their necks, in consequence of which they often drop from their sockets, or become so loose as to be useless.

The gum, in common with the rest of the mucous membrane, is liable to sloughing, from excessive mercurial action, and probably also from causes which exert their influence chiefly through the constitution. Of this nature appears to be that variety of mortification which has been so ably described by the older writers under the name of "black canker," and by Coates\* and others of our own times, under that of the "gangrenous ulcer" of the mouth. This disease prevailed quite extensively, some years ago, in the marshy districts of New Jersey and Pennsylvania, attacking, for the most part, weakly children, between two and five years of age. Although it may begin at any part of the mucous membrane, yet, in by far the greater number of cases, it makes its appearance at the edges of the gum, over the neck of the central incisors of the lower jaw, in the form of a whitish, cineritious, or reddish ulcer, which varies in diameter, from half a line to the eighth of an inch. In this state, the disease may continue for several weeks, or even months; but more commonly it extends its ravages, affecting either a large portion of the dental arches, or passing down in the direction of the sockets of the teeth, which, together with their periosteum and the alveolar processes, are gradually deprived of their vitality. The soft parts, in the meanwhile, assume a dirty blackish appearance; and, on being detached, they leave a ragged, sloughing ulcer, which is the seat of a foul, sanious discharge, of so excessively acrid a nature as to excoriate whatever texture it may happen to come in contact with. In this manner, the disease appears to be frequently propagated to the mucous membrane of the cheeks and lips, where it generally spreads with great rapidity, until the parts are completely perforated, or a black gangrenous spot manifests itself upon the external surface.

\* Description of the Gangrenous Ulcer of Mouths of Children. By B. H. Coates, M.D., one of the physicians of the Philadelphia Children's Asylum. North American Medical and Surgical Journal, vol. ii., 1826.

The true pathology of this disease is still enveloped in obscurity. It is almost wholly confined in its attacks to young, weakly subjects; and, from the researches of Dr. Coates and others, it would seem occasionally to display an endemic tendency. Out of two hundred and forty children observed by this physician in the Philadelphia Asylum, upwards of seventy were more or less affected with the primary ulcer at one time. In the early stage of the complaint, there is little or no pain, the system is free from excitement, and the appetite and strength are scarcely at all impaired. When the sloughing process, however, has fairly commenced, the child suffers much local distress, and is harassed with constant fever. Dissection has thrown no light on this singular variety of gangrene.

Another disease, which is deserving of mention here, is *alveolar abscess*, or, as it is familiarly termed, gum-boil. Although this may be produced by a great variety of causes, yet the most common by far is the irritation of toothache, or the existence of a dead fang. This, acting as an extraneous body, excites inflammation in the periosteum of the alveolar cavity, followed by an effusion of plastic lymph, which becomes condensed into a sac, in the centre of which pus is formed. This sac, which is commonly of an ovoidal figure, closely embraces the root just above its extremity, which is, as it were, bathed in the purulent matter. The quantity of pus cannot of course be great; but the pressure which it exerts upon the investing parts always induces ulcerative absorption, by which it gradually makes an outlet through the gum, generally opposite the base of the dead fang.

VI. The *tonsils* are two small bodies, about the size of an almond, situated between the arches of the soft palate. They are of an elongated, oval shape, of a firm, glandular consistence, and are composed of a great number of mucous follicles, connected together by short, cellular substance. The internal surface of each presents several small apertures, which lead into cells, that secrete a viscid, mucous fluid. They are exceedingly vascular, and of a reddish-grey color.

*Tonsillitis*, popularly called quinsy, is a very common complaint in cold and variable climates, particularly in spring and autumn. It is occasionally epidemic, but never contagious, and often coexists with laryngitis, bronchitis, pneumonia, scarlatina, small-pox, and measles. It is more frequent in the male than the female, and generally affects both glands simultaneously, though seldom in an equal degree. The disease may occur at any period of life, but is most common in children and young adults. It is announced by a sensation of dryness, heat, and pain in the fauces, with difficult deglutition, and a high grade of febrile excitement. On inspecting the throat, the organ is found to be considerably swollen, and of a uniform cherry-red color. The natural secretion is at first partially suspended, but in a short time it augments in quantity, becomes remarkably tenacious, and presents a pale, cream-like aspect. When the inflammation is at its height, the surface of the organ is of a dark purple or modena color, traversed by an immense number of capillary vessels, and incrustated with patches of lymph, of a dirty-greyish tint, tough, firmly adherent, and resembling superficial sloughs. The swelling is often so great that the glands touch each other at the median line. The proper substance of the tonsil is unnaturally soft, infiltrated with serosity, vascular, and of a deep fleshy red, with various shades of brown, violet, and purple. Occasionally small ecchymoses are observed beneath the mucous membrane, and in violent cases pure blood is effused in the parenchymatous texture. When there is much swelling, the mouths of the mucous follicles



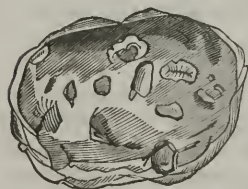
are either entirely obliterated by compression, or closed with thick, viscid mucus, or plugs of fibrin.

This disease is seldom wholly confined to the tonsils. In the generality of cases, it extends to the root of the tongue, the uvula, the curtain of the palate, and even to the Eustachian tube, giving rise to pain in the ear and to partial deafness. Occasionally it affects the larynx.

Tonsillitis often terminates in *suppuration*. The period which intervenes between the commencement of the inflammation and the occurrence of this process, varies from six to eight days. The pus, which is generally excessively fetid, is of a thick, cream-like consistence, of a pale yellowish color, and frequently intermixed with flakes of lymph. It is commonly deep-seated, and almost always breaks into the mouth. In a few rare instances it has been known to work its way out under the angle of the jaw. In a case observed by Londe, the matter passed down the neck along the great vessels, and finally penetrated the chest, where it speedily induced fatal inflammation. It is seldom that both tonsils suppurate at the same time.

One of the most frequent affections of the tonsils is *hypertrophy*, induced by frequent attacks of chronic inflammation. The organ in this disease is enlarged in all directions, and is of a firm, almost fibro-cartilaginous consistence; its surface is of a pale reddish, or cineritious hue, and its mucous follicles are often five or six times the natural size. (Fig. 130.) Sometimes the orifices of these follicles are closed with inspissated mucus, earthy concretions, fibrinous plugs, or tubercular matter. Instead of being tough and indurated, the organ may be remarkably friable, distinctly lobulated, and of a red, brownish, or violet complexion. This state is most common in children under ten years of age. Hypertrophy of both tonsils is apt to be at-

Fig. 130.



tended with defective speech, hearing, and breathing, together with a singularly altered condition of the chest, which is rounded and arched behind, contracted in front, and flattened at the sides. The neck is bent forwards, and the patient labors under a habitual stoop. During sleep the breathing is excessively embarrassed, the head is thrown back, so as to bring the mouth on a line with the larynx, and the surface is bathed with perspiration; effects evidently produced by the inordinate action of the respiratory muscles to overcome the mechanical obstacle which the enlarged glands offer to the introduction of the air into the lungs. The disease, which often continues for years, occurs mainly in persons of a scrofulous predisposition, and is seldom, if ever, witnessed in advanced life.

*Gangrene*, as a termination of this disease, is extremely rare. The event is announced by the fetidness of the breath, the livid state of the parts, and the dark, sanious discharge from the throat. On examining the tonsils after death, they will be found pulpy, disorganized, and of a deep grey, ash, or mahogany color. Ulceration and sloughing of these parts are very common in some of the exanthematous fevers, and in none more so than in scarlatina.

In syphilitic affections of the throat, the tonsils are often the seat of *ulceration*, of which several forms have been recognized by authors.\* The first is the excavated ulcer, which exhibits the appearance of a deep hollow, as if a portion of the organ had been scooped out, with a dirty ash-colored bottom, and red, elevated margins. In the second form, which usually coexists with papular eruptions on the arm and shoulder, the ulcer is narrow and superficial, sometimes, indeed, a mere fissure; but the edges are often irregular, indented,

\* London Cyclopædia of Practical Medicine, vol. iv., p. 186.

and apparently coated with lymph. The tonsils in both these cases are considerably enlarged, and preternaturally red; yet there is rarely much pain, or difficulty of swallowing. A third form is the phagedenic, which commences in a small aphthous speck, surrounded by a deep erysipelatous blush, and rapidly proceeds over the organ to the neighboring parts, involving them often in one common slough.

The tonsils, in common with other parts of the body, are liable to some, if not all, of the heterologous formations. Of these the most common is the *tubercular*, of which I have seen a considerable number of well-marked examples. The matter is of a pale yellowish color, semi-concrete, and arranged in small, isolated particles, from the volume of a pin-head to that of a hemp-seed or a pea. It may undergo more or less complete softening, and is often transformed into chalky concretions. The disease is generally associated with hypertrophy of the gland and tubercular deposits in other structures, particularly the lungs and lymphatic ganglions: it is most common in young scrofulous subjects.

Encephaloid of the tonsils has been observed by Velpeau, Vidal, Carswell, and other pathologists. The disease, however, is exceedingly rare, and usually coexists with similar deposits in the organs. It may occur as an infiltration, but most commonly presents itself in disseminated masses, or as a solitary tumor, of variable form and size.

The two forms of carcinoma, termed scirrhus and melanosis, scarcely ever attack this organ. Indeed, I am not aware that there is a single instance of the latter on record; as to the former, although Dr. Warren\* regards it as not infrequent, it is unquestionably a very rare disease. The cases described by this distinguished surgeon are, at all events, of such a nature as to leave a doubt whether they were really of a true scirrhus character or not.

Dupuytren, in excising a tonsil from a woman in the Hotel-Dieu, met with what he supposed to be an *acephalocyst*. The pouch was of a white, opaline tint, elastic, and occupied with a limpid, serous fluid, but did not contain the ordinary globular hydatid. The gland had acquired a considerable magnitude, and exhibited all the appearances of common hypertrophy. No other surgeon, I believe, has noticed this disease, and little, therefore, is known respecting it. May it not have depended upon obstruction and consequent dilatation of one or more of the tonsillitic follicles?

The tonsils is sometimes the seat of *chalky, calcareous, or earthy concretions*. They may be situated in the parenchymatous texture of the gland, or, as is more commonly the case, in its follicles or excretory ducts. Their composition is phosphate and carbonate of lime, agglutinated by a small quantity of animal matter. They have usually a white, greyish, or light brownish color, spherical figure, and finely tuberculated surface. Their volume seldom exceeds that of a mustard-seed. In number they vary from one to half a dozen, or upwards. They have occasionally a lamellated arrangement with a distinct central nucleus.

Concretions of a purely animal character occasionally block up and distend the lacunæ of the tonsils. They are of a whitish, greyish, or yellowish tint, unctuous or greasy to the touch, extremely fetid, and from the volume of a hemp-seed to that of a pea. Their composition appears to be fibrin in union with mucus.

VII. The lesions of the *soft palate* do not differ, on the whole, from those of the tonsils, and any labored description of them would therefore be superfluous.

*Polypes* sometimes grow from this part. Sir Astley Cooper† relates two

\* On Tumors, p. 356.

† Lectures by Tyrrel, p. 348.

cases of this kind, in one of which the excrescence was attached over the palato-pharyngeal muscle, and hung down like a sausage into the fauces : it was of considerable size, soft, and of a florid color.

*Split-palate* is a congenital defect, analogous to hare-lip, with which it generally coexists. It occasionally affects only the soft parts, in which case there is no lack of substance, but the opposite halves recede from each other at an angle of about thirty degrees. When the maxillary and palate bones are involved, the fissure always corresponds with the mesial plane, and is sometimes so great as to throw the buccal and nasal cavities into one large sinus. In cases of this kind, there must be an entire absence, of course, both of the vomer and of the perpendicular lamella of the ethmoid. Even the cribriform plate of this bone may be deficient, the olfactory nerve wanting, and the cerebrum considerably malformed.

Of the diseases of the *uvula*, too little is known to enable us to give any satisfactory account of them. Like the soft palate, it originally consists of two lateral pieces, which, in some instances, remain ununited at the raphe, thus forming a congenital defect parallel to hare-lip and split-palate. This malformation, however, rarely exists singly. The most common lesion of the uvula, undoubtedly, is *hypertrophy*, in which it becomes both longer and more bulky. Its structure also is sensibly altered, being much harder than in the natural state : its vessels are much enlarged, and its color is a light greyish, instead of a florid red. The consequences of such changes are well known. The part becomes troublesome in deglutition and talking, and causes a disagreeable tickling at the root of the tongue, attended with an annoying cough and frequent retching.

Gangrene rarely affects the uvula. In anginose inflammation, it is often completely incrustated with a thick membranous lamella, which is detached either piecemeal or in the form of a nipple-shield, a thimble, or the finger of a glove. In syphilitic sore throat, the uvula is sometimes entirely destroyed ; at other times it is perforated at its base.

VIII. The lesions of the *pharynx* resemble, for the most part, those of the tongue and tonsils ; but there are several which are peculiar, and which therefore demand separate consideration.

Acute *pharyngitis* is characterized, ordinarily, by redness and tumefaction of the affected part, with a secretion of thick, greyish mucus. In the more severe forms, however, there is, additionally, an effusion of lymph, which appears either in small patches, or, as is more frequently the case, as a continuous layer over the whole surface of the reservoir. Hence, on the one hand, the exudation generally extends upwards over the tonsils and the soft palate ; and, on the other, downwards into the œsophagus, the larynx, the trachea, and even the bronchial tubes. Much diversity obtains in regard to the color and consistence of these adventitious membranes. When first formed, they are usually of a light yellowish tint, and so soft that they can be easily wiped off with the finger ; in a short time, however, they become greyish, and acquire considerable tenacity, forming pretty hard incrustations. In very intense cases, blood is apt to be exhaled, which, mixing with the exudation, imparts to it a dark brownish hue. The mucous membrane itself is of a deep livid complexion ; the subjacent cellular tissue is infiltrated with serosity ; and all the vessels are engorged to such a degree that it is impossible either to inject or unload them by pressure and ablution.

This disease, which has been so ably portrayed by Dr. Bretonneau, of Tours, under the name of *diphtheritic* inflammation, is by no means an uncommon attendant on small-pox and scarlet fever, but also occurs very frequently as an idiopathic affection in children, especially in such as are naturally weak, or



who have become so by indisposition or impoverished diet. The symptoms, as might be expected, are generally severe; and, when the exudation extends down the air-passages, death is often induced by suffocation, precisely as in pseudo-membranous croup.

*Abscess* of the pharynx is of rare occurrence. The matter is seated in the cellular tissue behind the mucous membrane, and may show itself as the result of acute inflammation, or of tubercular irritation. Of the latter form of the disease I have observed several instances in subjects of a strumous constitution. In one, a young man between twenty-five and thirty, the abscess was situated on the left side of the middle line, and contained nearly an ounce of thin, greenish pus, intermixed with caseous substance. The tumor which fluctuated under the finger, produced so little inconvenience that the patient, who was far advanced in phthisis, had not even suspected its existence. The mucous membrane of the pharynx, both over and around the abscess, exhibited no unusual appearances.

When the abscess is acute, the matter, although usually small in quantity, may, by pressing on the glottis, produce great distress in the throat with dysphagia, aphonia, and dyspnoea, followed in some instances by death. The diagnosis is always difficult, and the affection dangerous. The pus is sometimes quite fetid, but generally it is of good quality; it may extend down behind the œsophagus, and in this case amount to six or eight ounces.

The pharynx is occasionally the seat of tubercles, of scirrhus, and of encephaloid. When the latter of these growths attain a considerable magnitude, as they sometimes do, they are apt to prove troublesome by their mechanical obstruction. Mayo records a case where a scirrhus tumor, attached to the laryngeal surface of the pharynx, gradually filled the passage, and at length produced death by inanition. Polypous growths are seldom met with in this situation. The only instance, indeed, of which I have any knowledge is that related by Professor Monro, of Edinburgh. It adhered to the fore part of the pharynx by a narrow root, and was of such a length that whenever the patient retched, it was thrown forward against the incisor teeth.

The pharynx is liable to become *sacculated*, a blind pouch being sometimes formed at its junction with the œsophagus. This is most apt to happen at the posterior part, and the disorder is chiefly inconvenient, as having a tendency to entrap particles of food in their descent from the mouth to the stomach. A bag capable of holding several ounces has been thus formed.

IX. The diseases of the *œsophagus*, though much less numerous than those of the mouth and fauces, are not less dangerous in their tendency, or less interesting to the student of morbid anatomy. Amongst the most important of these lesions may be mentioned diphtheritic inflammation, ulceration, softening, stricture, and scirrhus degeneration. In its structure, the œsophagus very closely resembles that of the intestinal canal, excepting that it is furnished with a distinct epidermis, which abruptly disappears at the cardiac extremity of the stomach. Its inner surface is of a whitish color, longitudinally wrinkled, and perforated by a great number of follicles, situated beneath the proper mucous coat.

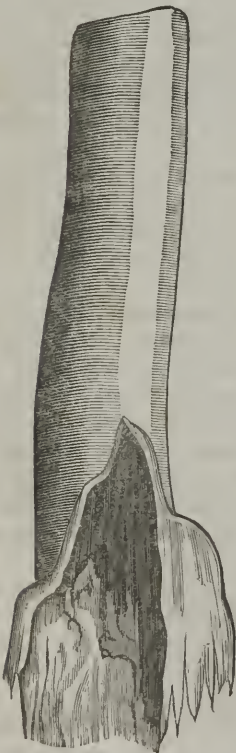
Simple *œsophagitis* is marked by the usual symptoms of redness, pain, and tumefaction, with dryness of the part, and difficulty of deglutition. In violent cases, as, for example, when the inflammation is caused by corrosive poisons, there is an abrasion of the cuticle, and an effusion of lymph. The diphtheritic form of the disease is often witnessed in hydrophobia; and there is reason to believe that it is sometimes caused by a suppression of the cutaneous perspiration. A remarkable instance of this is mentioned by Dr. Abercrombie, of a gentlemen who caught cold in travelling to Edinburgh. The fauces were of

a slight red color, and he complained of great soreness of the throat, with hoarseness of the voice, and considerable difficulty of swallowing. His case at length assumed a typhoid character, and at the end of about three weeks from the commencement of the disease he died. On examination, the whole of the œsophagus was found to be lined by a soft adventitious membrane; and a similar exudation was traced over the pharynx and epiglottis.

In the winter, of 1838, Dr. Bamford sent me the stomach and œsophagus of a boy, thirteen years old, who suddenly expired in convulsions after an illness of three days. The patient complained of severe pain in the fauces, and had great difficulty of swallowing, every attempt of the kind being followed by spasm of the throat, especially when the substance was of a fluid nature. On inspecting the œsophagus, I found it lined throughout by a thin layer of lymph, closely adherent to the natural mucous coat, which was itself highly injected, and of a bright red color. The stomach was perfectly sound, the inflammatory appearances terminating abruptly at the cardiac orifice. Dr. Mount, who attended the lad, and was present at the examination, informed me that he traced the adventitious membrane also around the mouth of the larynx and over the whole of the fauces.

These membranes rarely become organized. When the inflammation subsides, they gradually lose their moisture together with their adhesive properties, and are either vomited up in small tubular fragments, or swallowed and digested, or passed by stool. Andral\* refers to a case where an exudation of this kind was found in the œsophagus of a new-born infant. It lined the tube for about a third of its extent, and seemed to be almost identical with its substance. Fig. 131 represents a tubular piece of lymph cast off by the œsophagus during a fit of vomiting. The patient, a man about thirty years of age, was affected with mania-a-potu, of which he finally died. The drawing is from a preparation in my cabinet.

Fig. 131.



Ulcers of the œsophagus most frequently occur at the upper part of the tube, near its junction with the pharynx. They may be of various forms and dimensions; and, in the generality of cases, their edges are smooth and but little thickened. When, however, as it sometimes happens, they are associated with scirrhus, the surrounding structure is very much elevated, and often consists of a dense fleshy substance, interspersed with gristly matter. These ulcers sometimes lead to perforation, though this is of rare occurrence.

Abscesses sometimes form between the coats of the œsophagus, and, by compressing the trachea, affect the breathing. When very large, they encroach upon the caliber of the gullet, and impede deglutition. Dysphagia also sometimes results from enlargement of the thyroid gland, projection of the dorsal vertebræ, and aneurism of the aorta. In a man, forty-nine years of age, whom I examined in 1827, the œsophagus and aorta communicated by a large aperture, through which more than half a gallon of blood suddenly passed into the stomach, and thus caused death. The principal symptoms were

\* Pathological Anatomy, by Townsend and West, vol. ii, p. 172.

dyspnœa, spitting of blood, and pain in the inferior part of the chest, in the region of the gullet.

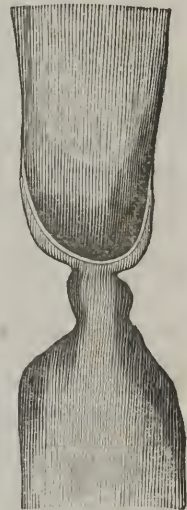
*Softening* of the œsophagus, of the same nature as that of the stomach, is sometimes observed. One of the most common effects of this lesion is a perforation of the walls of the tube, and an escape of fluid into the thorax. The opening usually occurs near the cardiac extremity of the œsophagus, in connection with an inflamed, softened, or perforated state of the stomach, though occasionally there is no appreciable alteration whatever in any of the surrounding textures. No age seems to be exempt from this lesion, and in one or two instances it has been observed even in the new-born infant.

*Stricture* of the œsophagus almost always results from inflammatory thickening of the submucous texture, with more or less alteration of the proper linings. A sort of ring, of variable depth and firmness, is thus formed (Fig. 132), which encroaches upon the channel, and produces great difficulty in swallowing, aggravated frequently by spasmodic exacerbations. In a case which I examined some years ago, the tube was so much contracted, that it would scarcely admit a common-sized quill. The stricture, which was about half an inch deep, and of gristly firmness, was seated within three inches of the cardiac extremity of the stomach, and the patient literally died from inanition. The ordinary place of stricture, however, is not so low down, but near the junction of the tube with the pharynx. In the early stage, the disease is curable by the use of bougies ; but, if it be neglected, the contraction progressively increases, and the œsophagus finally ulcerates, and opens into the posterior mediastinal cavity, the trachea, or the lungs. The part above the stricture is sometimes sacculated. Monro describes a case, in which the enlargement was so great that the patient could retain nearly a pint of fluid for ten minutes, and in the mean time converse with his friends ; in another, mentioned by Purton, the sac was capable of holding two quarts.\* Occasionally the stricture is of a spasmodic nature, being produced by the contraction of the circular fibres of the œsophagus. In this case, the difficulty is generally temporary, and may be easily overcome by a bougie.

The walls of the œsophagus are sometimes of a *scirrhus* hardness, or almost cartilaginous, and even ossified. Cases of this kind are referred to by Bonetus, Morgagni, and some of our modern writers ; but there is reason to believe that they are of very infrequent occurrence, especially when unassociated with stricture.

Dr. J. B. S. Jackson, of Boston, has recently reported a case of cancer of this tube opening into the right lung.† The patient was a female, fifty-three years of age, for the last eight or ten of which she had difficulty of deglutition, often attended with regurgitation of the food, but without pain or nausea. The skin was sallow, and the body quite emaciated. Latterly she had hemorrhage from the bowels, and about a week before her death she was attacked with acute pulmonary symptoms. The disease commenced two inches and a half above the inferior extremity of the tube, extending upwards in front one inch and three-quarters, and behind two inches and a half. The canal was as

Fig. 132.



\* London Medical and Physical Journal, December, 1821.

† New England Quarterly Journal of Med. & Surg. Oct. 1842, p. 253.



large here as elsewhere. The cancerous surface was ulcerated, soft, ragged and of a whitish aspect, not unlike encephaloid. The cut edge exhibited no trace of the original structure. At the centre of the diseased mass, on the anterior surface of the œsophagus, was a perforation through into the substance of the right lung, which was gangrenous at this part. The descending aorta adhered to the altered portion of the tube, and had upon its outer surface, near this point, an apparently malignant deposit. The right pleura, which was acutely inflamed, contained upwards of a pint of serosity, and the substance of the corresponding lung was of a dark brown color, soft and shreddy, the posterior inferior part presenting a superficial gangrenous patch, three inches in extent.

A considerable number of cases of *laceration* of the œsophagus are on record. The accident generally takes place during the act of vomiting, without any antecedent structural lesion. The rent is commonly transverse or somewhat oblique, and varies in extent from a few lines to half an inch or more. The inferior portion of the tube gives way more frequently than the upper or middle; sometimes the rupture is situated immediately above the cardiac extremity of the stomach. The accident is characterized by violent pain, with symptoms of sinking, and usually proves fatal in thirty-six or forty-eight hours.

The œsophagus, finally, is liable to various congenital *malformations*. These, although not of frequent occurrence, constitute a very interesting subject of study to the pathological anatomist. Nevertheless, a bare enumeration of them is all that we can hope to do, with any prospect of success, in the present state of our knowledge. The following arrangement will be found to embrace the most important deviations which have hitherto been observed: 1, the œsophagus terminates in a cul-de-sac, either within a few inches below the pharynx, or at a short distance above the cardiac extremity of the stomach; 2, it is obliterated, contracted, or converted into a solid cord; 3, it is unnaturally dilated, or even double; 4, it is totally deficient, the pharynx ending in a blind pouch, and the stomach having no cardiac orifice; 5, it communicates with the trachea. Of the latter variety, a highly interesting and instructive case was observed by Dr. Martin, of Marseilles, in an infant, that died thirty-six hours after birth. On dissection, there was found to be an entire absence of the pharyngeal extremity of the œsophagus; but an aperture existed in the trachea, just above its bifurcation, through which a probe could be passed into a thin, membranous, elastic tube, of the diameter of a small quill, that led to the stomach, and thus established a communication between the cavity of that organ and the air-passages.

## CHAPTER XX.

### OF THE STOMACH AND BOWELS.

#### SECTION I.

##### ORGANIZATION OF THE GASTRO-ENTERIC MUCOUS MEMBRANE.

1. *Organization of the Gastro-Enteric Mucous Membrane.* — Thickness and Consistence. — Cellulo-fibrous Tunic. — Mucous Follicles. — Glands of Brunner and Peyer. — Villositics. — Color of the Membrane; how modified by Age, Digestion, and other circumstances. — II. *Inflammation.* — Anatomical Characters of the acute form of the disease. — Increased Vascularity. — Dryness. — Thickening. — Softening. — Deposition of Lymph. — Formation of Vesicles. — Effusion of Blood and Serum. — May pass into Gangrene or become Chronic. — Encysted

tumors.—III. *Softening*; of two kinds, from Inflammation, and the action of the Gastric Juice.—Experiments of Hunter and Carswell.—IV. *Diseases of the Stomach*.—Ulceration.—Hypertrophy and Atrophy.—Formation of Pouches.—Cartilaginous Degeneration.—Carcinoma.—Laceration.—V. *Lesions of the Duodenum*.—VI. *Affections of the small Bowels*, properly so called.—Ulceration of the isolated Crypts and of the Glands of Peyer.—Typhoid Fever.—Tubercular Deposits.—Milt-like Tumor of Monro.—Melanosis.—Intussusception.—Hernia.—Abnormal pouches.—Reparation of wounds.—Atrophy and Hypertrophy.—Earthy Concretions.—VII. *Lesions of the large Bowel and Anus*.—Uleers.—Wart-like Vegetations.—Singular Contraction of the Colon.—Carcinoma.—Fissure of the Anus.—Enlargement of pouches.—Organic Stricture of the Rectum.—Polypes.—Hemorrhoids.—Fistula.—Prolapsion of the Bowel.—Congenital Vices.—VIII. *Intestinal Worms*.—Lumbricoides.—Oxyuris.—Tricocephalus.—*Tænia Solium*.—*Tænia Lata*.

PREVIOUSLY to describing the different lesions of the sub-diaphragmatic division of the alimentary tube, it will be useful to take a rapid survey of the appearances which it presents in the normal state, as a knowledge of this kind will the better enable us to discriminate what is sound from what is morbid. The remarks, however, which I shall make, are designed to have more especial reference to the mucous membrane; upon which, as is well known, the violence of almost all gastro-enteric affections is mainly spent.

In the sound state, the alimentary tube is perfectly smooth, semi-transparent, free from adhesions, more or less vascular, and covered internally with a thin,ropy mucus. The thickness of its walls varies in different portions of its extent, being greatest in the duodenum, the stomach, upper half of the jejunum, and the rectum, and least in the ileum, the lower half of the jejunum, and the colon. In the latter situations, indeed, the tenuity is generally so considerable that the bowel on being spread out upon a printed sheet enables us to distinguish the letters, owing, doubtless, to almost entire absence of mucous folds and villousities.

With regard to the stomach, the thickness of the mucous coat varies remarkably in the cardiac and pyloric divisions. In the former it is comparatively thin and delicate, especially around the œsophageal orifice and in what is called the great cul-de-sac; but as we proceed towards the right side, it gradually augments in thickness, becomes more and more opaque, and is studded with an immense number of follicles, upon which these differences seem mainly to depend.

But there is no portion of the alimentary tube in which the mucous membrane is so thick and opaque as in the upper two-thirds of the duodenum. From thence on it becomes gradually thinner and thinner, until it reaches the lower division of the small bowel, where it is so delicate as to give the tube a semi-transparent appearance, except along the glands of Peyer. In the colon, the thickness of the mucous lining is considerably less at the right side, and at the commencement of the arch than in the descending portion or in the left half of the arch. The thickness appears again to diminish in the sigmoid flexure; but, on arriving in the rectum, it suddenly increases, and continues so to do until a short distance before it terminates at the margin of the anus.

The mucous membrane of the stomach and bowels has no epidermic covering, in which respect it differs essentially from that of the œsophagus. The existence of such a structure has, it is true, been admitted by numerous and highly respectable anatomists, from the time of Haller to the present moment. The peculiar manner in which the œsophagus is inserted into the stomach has induced many to believe that the epithelic lining of that tube terminates at the cardiac extremity of that viscus precisely in the same manner as the corresponding covering of the vagina at the lips of the uterus. Haller and

Bichat, acknowledging that it is impossible to demonstrate the epidermis of the alimentary canal, nevertheless maintain that we may infer its presence from the membraniform substances which are occasionally discharged from the bowels. This supposition, however, may be very easily controverted by the fact that all such excretions are the product of inflammatory action, one of the effects of which is an effusion of sero-albuminous matter, which, having acquired a certain degree of consistency, is gradually detached from the free surface of the mucous tunic, and finally expelled in the form of a distinct membrane, not unlike that of croup.

Exudations of the kind here adverted to are by no means uncommon, either in the gastro-pulmonary, or in the genito-urinary division of the mucous system. I shall hereafter have occasion to refer to cases in which they were noticed even in the urinary bladder, the vagina, and the uterus; and shall therefore content myself, for the present, with remarking that these membranous productions, no matter in what part of the body they are found, are always of a similar nature, both as respects their physical properties, and their chemical constitution.

Taking into consideration, therefore, the fact that these concretions are always the result of inflammatory action, and the circumstance, moreover, that they are essentially different from the epidermis in their appearance and composition, it is obvious that they cannot be adduced in favor of the opinion of the existence of such a structure in the gastro-enteric division of the mucous system. Did this membrane really exist here, is it not reasonable to suppose that it could be displayed by the same process that it can in the mouth, the œsophagus, or the vagina? But this has never yet, at least so far as I know, been done, the most careful dissection, maceration, and boiling having alike failed in accomplishing it.

The natural consistence of the mucous membrane of the alimentary tube is liable to considerable variation; but it may be stated, as a general rule, that it is in direct proportion to its thickness. Thus it is much more firm in the pyloric half of the stomach than in the cardiac; and it is in that situation, also, that it has the greatest degree of thickness. In the duodenum the rule does not hold good; for, although the mucous membrane is thicker and more opaque here than in any other portion of the digestive canal, yet, owing to the presence of the glands of Brunner, which are remarkably large and numerous, as well, perhaps, as to some peculiar mode of organization, the structure in question is exceedingly brittle, and can seldom be raised except in very small fragments. Lower down, the consistence of the membrane progressively increases, so that, in the inferior third of the jejunum and in the ileum, it may be torn from its connection, in pieces varying from three lines to half an inch in length. In the large bowel, the cohesive property again diminishes, and the membrane can be detached only in small shreddy patches. It need hardly be remarked that the normal consistence of the mucous coat of the alimentary tube is much less in the infant than in the adult. At what period of life it attains its maximum development in this respect, is a point concerning which we cannot communicate any positive intelligence, as it is a question which has not yet been determined.

The mucous membrane of the digestive organs is amongst those tissues which do not readily yield to putrefaction. The softening that is produced under the influence of this cause is always a very gradual process, and there can therefore be little danger of confounding it with that which results from the action of the gastric juice, or from inflammatory irritation. The changes in the surrounding organs, as well as in the other tunics of the alimentary tube,



which must always, to a greater or less degree, participate in the putrefaction, would be alone sufficient to enable us to distinguish the difference, and prevent any difficulty in relation to the subject.

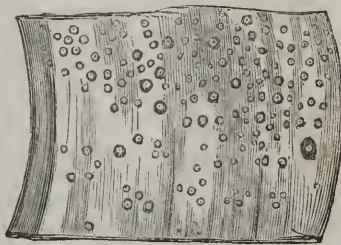
The tissue which serves as a bond of connection between the mucous and the muscular coats of the alimentary canal is of a cellulo-fibrous nature, and deserves to be attentively considered, from the important character which it plays in the different lesions of this part of the body. In the normal state it is of a pale greyish color, and very thin, yet so dense and tenacious as to be capable of great resistance. Sending a great number of minute processes between the muscular fibres, it is attached to the middle much more firmly than to the mucous tunic, and seems to consist of a very close, dense network, the filaments of which may be separated from each other by protracted maceration, by boiling, and careful dissection. It is this structure concerning which so much is said by the ancient anatomists under the name of the *nervous coat*.

This coat—for so indeed it deserves to be considered—is much more distinct in carnivorous animals than in herbivorous, or than in the human subject. In the small bowel of the lion and the bear, it forms a thick, opake lamella, of a whitish color, and of a fibrous consistence, which adds very much to the strength of the tube, and receives the larger ramifications of the vessels, preparatory to their distribution to the mucous membrane.

The mucous membrane of the stomach and bowels is furnished everywhere with minute *glands*, *crypts*, or *follicles* (Fig. 133), the study of which, in a pathological point of view, is of the very highest importance. In the normal state, these little bodies are always recognized with great difficulty, but are rendered very evident in certain morbid conditions, especially in chronic diarrhœa, cholera, dropsy, and pulmonary phthisis. Seated in the sub-mucous cellular tissue, they are covered over by the proper mucous corion, and are of an irregularly oval, rounded, or spherical shape, presenting each a minute orifice leading to a blind cavity. These glands, although they are found throughout the entire mucous system, have been most frequently examined in that part of the alimentary canal, where they occur in vast multitudes. In most situations, however, they are so much flattened, that they do not project sensibly upon the free surface of the mucous membrane, on which account they often appear to be much less numerous than they actually are.

In children, the gastro-intestinal follicles are naturally more developed than in adults, and consequently are much more easily recognized. In order to discern them distinctly, the mucous tunic must be thoroughly cleansed, and then held between the eye and the light, when they will appear like minute dots, of an opake greyish color, and with a delicate, central aperture, the margins of which are often quite dark. The difficulty of distinguishing these little bodies will be much lessened if the part to be examined be previously steeped in warm vinegar, as was first suggested, I believe, by Willis. I have frequently tried this method, and always found it advantageous. Their structure, so far as it can be ascertained by careful microscopic inspection, seems to consist of a congeries of vessels, connected together by the most delicate cellular texture. Their internal cavity, which can occasionally be beautifully displayed by inflation with the blow-pipe, is perfectly smooth and uniform, and constantly bedewed with a thin mucous secretion.

Fig. 133.



In the stomach alone the number of these glands amounts, according to the recent calculations of Professor Horner, to one million two hundred and sixty-six thousand; or, in other words, estimating the area of the inner surface of this organ at ninety square inches, he supposes that each cubic inch has fourteen thousand and four hundred follicles. In the intestinal tube, their number appears to be still greater. Allowing the area of the whole canal to be two thousand square inches, and that there are about twenty-two thousand of these little bodies on every inch, it would follow that the entire number, in the small and large bowels, is from forty-five to forty-eight millions. If this evaluation be correct, the mucous follicles must be infinitely more abundant than is generally imagined: as all microscopic observations, however, are liable to deception, and more especially as all these bodies can never be discerned at the same time, so as to enable us to count them, it is not improbable that the distinguished anatomist alluded to has fallen into error, his estimate far transcending the natural limits.

Fig. 134.



In their size, the mucous follicles vary in different parts of the gastro-enteric membrane. In the stomach, the largest are about the twelfth of a line in diameter, the smallest about the twentieth of a line. In the duodenum, where they are denominated the glands of Brunner, after a German anatomist who first described them, their volume is much greater, most of them being a line in diameter; and they are generally so prominent, especially for the first four inches of that tube, as to give the free surface of the lining membrane a peculiar granulated aspect. In the mesenteric portion of the small intestines, their dimensions are greater than in the stomach, but less than in the large bowel, where they are also more easily recognized.

Besides these isolated crypts, there are other mucous follicles which are limited to particular portions of the intestinal tube, and which have recently attracted the special attention of pathologists, from the appearances which they present in certain diseased states of the system. I need scarcely say that I allude to the *glands of Peyer*, or, as they are now very generally called by the French writers, the *elliptical plates*. (Fig. 134.) They occur almost exclusively in the lower half of the ileum, none having yet been observed, except, in a few instances, in the jejunum or duodenum. Their number is very variable; but, as a general rule, it may be stated that there are from eighteen to twenty-five. More than these are seldom seen, and rarely so many. In one instance I counted forty-five, and in another not less than seventy-three. In the latter case they extended high up into the jejunum.

The shape of most of these glands is elliptical; whence the epithet which has been applied to them by the French anatomists. Many of them, however, are circular, and not unfrequently they are remarkably angular. One or two, especially those near the ileo-cæcal valve, are occasionally T-shaped.

They are situated opposite the attachment of the mesentery, and are from a few lines to two inches in length, by five or ten lines in breadth, becoming



larger and more numerous as they approach the cœcum. Considerably elevated above the circumjacent parts, they impart to the finger a rough, mammillated sensation, and are easily distinguished by their opaque, greyish appearance. Often they are studded with minute dark-colored points, which indicate the mouths of the follicles which compose them, and of which there are in each patch, according to its dimensions, from twenty to several hundred. Dr. Lelut, a French writer, affirms that, by desiccation, a thousand of these crypts may occasionally be demonstrated in a single gland.

The seat of these glands, like that of the isolated follicles, is in the submucous cellular tissue. What their precise structure is, is a point which has never been satisfactorily determined by anatomists. That it is different from that of the glands of Brunner it is perfectly reasonable to suppose; otherwise why should they display such peculiarity of arrangement, and be confined exclusively to one particular portion of the alimentary tube? Another argument which may be adduced in support of their dissimilarity, is the fact that they are extremely prone to disease, and that they are frequently affected, nay, almost totally disorganized, and yet the isolated follicles remain quite sound. Ignorant, thus, of their true nature and character, how can it be presumed that we should know any thing of their functions? Are not the thousands and thousands of isolated follicles which every where stud the lining membrane of the ileum sufficient to furnish all the mucus that is required to lubricate its surface? Or does this portion of the digestive canal, so differently organized from the rest, perform some peculiar office, and consequently demand some peculiar secretion? All these are questions which, desirable as it would be, cannot be solved in the present state of the science.

Another distinguishing trait of the gastro-enteric division of the mucous membrane is the circumstance of its being covered with numerous *villosities*, which give it the feel and aspect of a piece of velvet. These are minute, delicate little bodies, which, although seen by Assellius and others, were first accurately described, in 1721, by an anatomist of the name of Helvetius. Extremely numerous in the small intestines, especially in the duodenum and upper half of the jejunum, they are supposed by some to be wanting in the stomach and colon; which, however, is not the case, as any one may assure himself by careful examination with the microscope, or even, in certain pathological conditions, with the naked eye.

The villosities are best seen by inverting a portion of bowel, and then immersing it in clear water, when they can be made to move gently amidst the fluid, in the form of minute processes, projecting from the free surface of the mucous membrane. About the fifth of a line in length, they are much larger in the upper than in the lower portion of the digestive tube, and, when injected, or rendered turgid, as they naturally are during chylicification, they acquire almost double the ordinary volume. They are arranged very compactly, and, as there are about four thousand upon every square inch, Meckel supposes that the whole number of them may be estimated at more than one million; an evaluation, doubtless, far short of the truth. In their shape, some of these bodies are conical, some cylindrical, some bulbous. Their vascularity is extremely great, the base of each being encircled by a delicate wreath of blood-vessels and lymphatics. Of their minute structure, as it has no relevancy to the subject before us, I forbear saying any thing on the present occasion.

Organized in the manner here stated, the gastro-enteric mucous membrane is most liberally supplied with blood-vessels, with nerves, and with lymphatics. If we examine a portion of bowel, and carefully trace its vessels as they creep along beneath the peritonæal covering, it will be seen that, as they ap-



proach the submucous cellular tissue, they gradually decrease in size as they augment in number, until finally they resolve themselves into a beautiful capillary network. These ultimate ramifications, which are divided to an infinite degree of minuteness, being much smaller than the finest hair, are spread over the adherent surface of the mucous corion, where they intersect one another in every conceivable direction; thus giving the intestine, when they are filled with size and vermilion, the appearance almost of a piece of scarlet cloth. The intervals of this vascular net are occupied by follicles and villousities, which are themselves, as before intimated, most abundantly supplied with vessels and nerves, every thing relating to their organization being of the most delicate and exalted character.

How the capillaries of the mucous membrane terminate is a problem which, although it has engaged a large share of the attention of the anatomists of all ages, has not yet been satisfactorily solved. The thin sero-mucous fluid with which it is constantly moistened, induced Haller, and since his time Bichat, Scemmering, and others, to infer the existence of arteries with open mouths, or, in other words, exhalant vessels. But, as no such vessels have yet been discovered, or satisfactorily demonstrated, the most philosophical explanation that can be offered, in the present state of our knowledge, is, that the capillary arteries in question communicate directly with the capillary veins; and this doctrine, I conceive, is amply sustained not only by the phenomena which are witnessed in the mucous membrane of the stomach and bowels of living animals, but likewise by what is observed in minute artificial injections.

But concerning no one subject is it of so much importance to have correct ideas as of that which relates to the *natural color* of the gastro-enteric mucous membrane. Much as this point has occupied the attention of anatomists, it is to be feared that our information is still very far from being satisfactory. Nor, indeed, considering the difficulties attending the investigation, could this be expected to be otherwise. Seated beyond our visual reach, it is only by accident, as it were, that we can at all approach the mucous membrane in the healthy state; and, although every opportunity has been diligently embraced to ascertain its normal appearances, yet so discrepant are the statements of the observers who have distinguished themselves in this field of physiological inquiry, that it is often extremely difficult to reconcile them, and sometimes impossible to draw from them any useful deductions.

That the color of the gastro-enteric mucous membrane should vary in the different periods of life, no one can doubt; nor, considering that the physical cause of it is the accumulation of blood in the capillary vessels, can it appear strange that it should be influenced by the state of the general system, and by the state of vacuity, or repletion of the organs which this texture serves to line. It may indeed be assumed, as a general proposition, that the color of the villous coat of the stomach and bowels is different in the child from what it is in the adult; that it is deeper in the strong and robust than in the weak and sickly; and that it is several shades lighter when these reservoirs are empty than when they are distended with food.

In the fœtus, and the child soon after birth, the color of the mucous coat is of a light rose, interspersed with small milky spots; in the adult, it is more of a whitish appearance, but still preserves some degree of its reddish tint; towards middle life, it assumes a dull greyish aspect, which continues, gradually increasing, until finally, in decrepitude, it becomes quite cineritious.

During digestion, the mucous membrane of the stomach is of a light red color, approaching almost to vermilion, especially in young subjects from the second to the tenth year. (Pl. V, Fig. 1.) The duodenum, and occasionally



Plate V

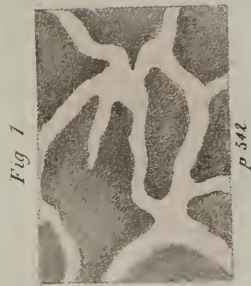


Fig. 1

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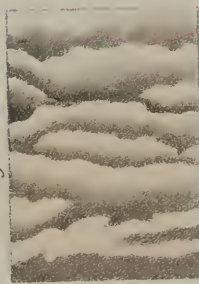


Fig. 2

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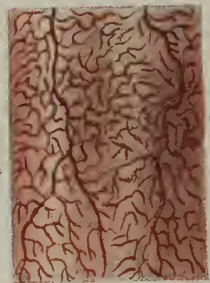


Fig. 4

p. 547



Fig. 5

p. 547



Fig. 7

p. 551



Fig. 8

p. 553



Fig. 3

p. 547



Fig. 6

p. 548



Fig. 9

p. 555







even the jejunum, participate in this increased vascularity, which always diminishes in proportion as the process of chymification advances to completion. Except from this circumstance, this portion of the small intestine never presents that red dye which has been ascribed to it by different writers. Although this redness uniformly exists, to a greater or less extent, during digestion, yet there is no doubt it is essentially modified by the quality, as well, perhaps, as by the quantity of the food.\* (Pl. V, Fig. 2.) Gendrin ascertained that if two dogs, of the same size and age, be fed, the one upon milk, and the other upon fatty broth, highly seasoned with salt and pepper, and both be killed an hour after, the mucous membrane of the stomach of the latter will be of a much deeper red than that of the former, at the same time that the augmented vascularity will extend much further down the small bowel. From this circumstance, which exerts so great an influence upon the rest of the alimentary tube, the ileum and colon experience little or no variation in their appearance.

The redness which supervenes during digestion is remarkably lessened, but

#### EXPLANATION OF PLATE V.

Fig. 1, p. 542; color of the mucous membrane of the stomach during digestion. The rugæ are seen of a lighter tint than the surrounding parts, which are of a bright red, bordering on vermillion.

Fig. 2, p. 543; color of the mucous membrane of the jejunum during chylickification. The redness is somewhat less than in Fig. 1, and is most conspicuous in the intervals between the winking valves. In both figures the color is considerably higher than when these reservoirs are in a state of vacuity.

Fig. 3, p. 547; a portion of mucous membrane in a state of inflammation. The redness is greater at some points than at others, and the vessels are spread out in a beautiful arborescent manner.

Fig. 4, p. 547. This drawing represents a higher degree of inflammatory irritation; the redness is more diffused and uniform, and the capillary vessels are arranged so as to form a delicate network.

Fig. 5, p. 547; section of the stomach. The mucous membrane is thrown into folds and the free surface presents an immense number of small points, produced by a slight extravasation of blood into the submucous cellular substance, or the mucous corion.

Fig. 6, p. 548; illustrates the diffuse discoloration produced by high inflammatory action. The redness, which is of a darker color than in the arborescent, dot-like, and capilliform injection, is uniformly diffused, and the small vessels seem to have disappeared.

Fig. 7, p. 551; a portion of bowel, the mucous membrane of which is incrustated with a thin layer of lymph, of a soft consistence, and a light-greenish color.

Fig. 8, p. 553; shows the effects of the acid and gaseous contents of the stomach upon the blood.

Fig. 9, p. 555; *a a*, acute inflammation of the isolated follicles; *b b*, ulceration of the mucous corion, which probably commenced in the glandular texture.

\* Dr. Beaumont, of the United States army, who had the rare opportunity of inspecting the gastric mucous membrane through a fistulous channel in the abdomen, states that the color of the inner surface of St. Martin's stomach, when empty, was usually of a pale pink; but that, on the application of food, the action of the vessels became augmented, and the color of the villous tunic considerably heightened.



never completely effaced by exsanguification. Of this any one may convince himself by opening an animal during the process of chymification, and cutting across the aorta and vena cava, the latter especially, which, as is well known, has always the effect, when divided, of giving the surface of the alimentary tube a pale, blanched appearance.

The color of the gastro-enteric mucous membrane is considerably influenced by the kind of death. In general, the rosy tint very much diminishes, so that we commonly find in young children that have died of protracted diseases, an unnatural pallor, amounting sometimes almost to a milky whiteness. In persons who are drowned, hung, or otherwise asphyxiated, the inner surface of the stomach and bowels is often of a crimson color, occurring either continuously or in large patches. Dr. Yelloly, of England, who has devoted much attention to this subject, states that he has observed this condition of the mucous coat of the stomach successively in five executed criminals; and Professor Monro, of Edinburgh, informs us that he has repeatedly, under similar circumstances, seen the gastric lining of a tile red. In a mulatto woman, who was executed in Kentucky, in the winter of 1835, and whose body I had an opportunity of inspecting soon after the event, the whole mucous surface of the alimentary tube was so deeply injected, as to present a deep lake color, especially distinct in the stomach, and in the inter-valvular spaces of the jejunum. Similar phenomena I have had occasion to witness in a female who was destroyed by manual strangulation, in a man who hung himself, and in dogs and rabbits asphyxiated for experimental purposes.

In an individual who died very suddenly from ossification of the coronary arteries, and whose abdominal viscera seemed to be in every respect sound, Professor Horner found the mucous coat of the stomach thrown into numerous folds, the sides and summits of which were of a bright brownish color, produced apparently by thousands of microscopic points of blood, detained in the capillaries: in the depressions between the wrinkles, the organ was of a dull pearl color. The jejunum was of a still deeper hue, and of a more uniform tinge than the stomach. The mucous coat of the colon was of a dull greyish color. In another person, who died within half an hour after eating a hearty meal of soup, bread, and potatoes, the lining membrane of the stomach was, throughout, of a red crimson hue, and that of the intestines of a light brownish.

If an animal be kept without food for three or four days, and then killed, the stomach and bowels will be found to be of a red rosy color; the mesenteric vessels considerably distended with blood; the isolated follicles enlarged; and the villous membrane unnaturally rough, softened, and easily detached. Not unfrequently, indeed, the color of these organs, under such circumstances, will be of a cherry red, bright lake, or vermilion. If the abstinence, however, be prolonged for a considerable period, then the mucous membrane, participating in the general anemia of the system, will be apt to be pallid, though cases occasionally occur, even in the human subject, in which the reverse of this obtains.

Various substances, when taken into the stomach, have the property of imparting to the mucous membrane a deep red color, which may be mistaken for the effect of poison. Of this nature, are the infusions of logwood and red poppy, together with black currants, the tincture of cardamom, and the compound spirits of lavender. A knowledge of these facts is of much importance in a medico-legal point of view; as a person, after having swallowed some one or other of these substances, might suddenly expire, and from the mucous membrane of the stomach and bowels being found of a red tinge, the sus-

picion might arise that he had been poisoned. Of this a most instructive case is recorded by Foderé, in his learned treatise on juridical medicine.

It was stated in a previous part of this work, that the nitrate of silver, when taken internally for a long time, had the effect of staining the external integument with a grey slate color. Similar results follow in regard to the mucous membrane of the alimentary canal. In a case examined by Dr. Rayer, of Paris, where the substance in question was taken for thirteen months, for the cure of epilepsy, consequent on disease of the brain, the internal surface of the whole alimentary tube, together with the interior of the mouth and sides of the tongue, was of a grey slate color. In the stomach the tint was extremely deep, and uniformly diffused; in the bowels, it was somewhat more faint, but still quite appreciable, and was interrupted here and there by minute vascular specks. The skin exhibited a precisely similar hue. The above case is by no means a solitary one.

In traumatic fever, caused by wounds of the head or extremities, the mucous membrane often assumes a bright reddish color, which, although it does not seem to be always associated with derangement of the digestive passages, cannot be easily removed by exsanguification. This fact, which seems to have been first experimentally ascertained by Gendrin, has been fully corroborated by the later researches of Mr. Swan,\* of London. The numerous observations of this distinguished anatomist have proved, in the clearest manner, that the insertion of any of the mineral poisons, or even mercurial frictions, on the back of a dog, after shaving off the hair, communicates a red color to the villous coat of the whole alimentary tube.

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## SECTION II.

### OF INFLAMMATION OF THE GASTRO-ENTERIC MUCOUS MEMBRANE.

With these preliminary observations concerning the healthy structure and appearances of the gastro-enteric mucous membrane, designed to enable the young pathologist to avoid some of the many difficulties which beset this most interesting field of inquiry, I proceed, secondly, to take up the subject of its morbid anatomy. In entering upon this important topic, I do not deem it necessary to consider the lesions of each portion of the alimentary tube separately; to do so, indeed, would only lead me into useless repetitions, and compel me at each step to recount what has been already stated. Possessing the same structure, the stomach and bowels, small as well as large, must be liable to the same diseases, whether acute or chronic, whether simply inflammatory or organic; and therefore, for all practical purposes, there can be no reason whatever why they should not be all described under one general head. Nevertheless, the method that will be pursued in the following pages will be somewhat different from that which the plan here stated might be presumed to indicate. Thus, after having discussed the subject of acute inflammation, together with its several terminations, with reference to the gastro-enteric mucous membrane generally, I shall proceed to speak of the various organic lesions as they affect each section of the alimentary passages in particular. Adopting this method, I shall be enabled the better to point out, what may be deemed of no trifling utility, the patho-

\* Monro, *Morbid Anatomy of the Gullet, Stomach, &c.*, p. 313.

gnomonic symptoms, so far as they are known, of those chronic affections of the stomach and bowels which are such a stumbling-block to the young practitioner.

The signs which anatomically characterize *acute inflammation* of the mucous membrane of the alimentary tube are, increased vascularity, loss of transparency, dryness, thickening, softening, deposition of lymph, and the formation of small vesicles, with alteration of the natural secretion and effusion of serum into the submucous cellular tissue. How far each of these phenomena is to be regarded as denotive of diseased action, I will now endeavor, as concisely as possible, to point out.

The first perceptible effect produced in the inflamed membrane is a change of color, resulting from an augmented flow of blood to the affected part. The shades of tint induced by this species of irritation are extremely numerous, but may be properly referred to modifications of red, brown, slate, and black. Of these, the first is by far the most common in acute inflammation, whilst the other three are more usually the product of a chronic process, in which the coloring principle of the blood, perfectly incorporated as it were with the mucous texture, is variously altered in its properties, either from simple stagnation in the minute capillaries, or from contact with the acid and gaseous contents of the alimentary tube.

The inflammatory redness, although sometimes widely diffused, usually occurs in small irregular patches, separated by intervals of sound membrane. Varying in diameter from a few lines to several inches, they often project sensibly beyond the level of the circumjacent parts; and, in violent cases, are always of a bright red color, looking a good deal like so many pieces of scarlet velvet. Connected with this augmented vascularity, are commonly to be observed certain changes in the mucous and subjacent textures. In the early stage of the disease, there is perhaps merely a slight degree of opacity, with a rugose condition of the free surface of the membrane. Afterwards, however, as the inflammation progresses, the reddened patches lose their tenacity, and become covered with a thick, ropy mucus, elevated into small vesicles, chapped, or fissured, or studded with flakes of lymph. Should all or several of these phenomena be present, no doubt can be entertained concerning the true nature of the disease: they are signs which no one can mistake, and which are as unequivocal as though they were drawn in characters of gold.

But it is not always that the inflammatory redness is thus distinctly marked; and hence much difficulty is sometimes experienced in discriminating between it and that which is natural. Attention has been already directed to the well-ascertained fact, that stimulating viands or drinks received into the alimentary canal produce an afflux of blood to the vessels of this cavity, by which the color of the mucous membrane is often so greatly heightened as to exhibit an appearance not unlike what is observed in inflammation. This circumstance should be constantly borne in mind in making post-mortem examinations, otherwise the most serious mistakes must frequently be the consequence. How, then, are these two conditions to be distinguished from each other? for upon the correct decision of this point hinges the pathology of a large number of the diseases of the stomach and bowels. The answer is obvious, — by comparison.

Thus, the inflammatory redness has rarely that uniform tint which is to be observed in the sound membrane; on the contrary, it is usually somewhat mottled, and, instead of terminating, as does the other, by insensible gradations, it almost always stops abruptly. Most frequently the inflammatory discoloration occurs in small irregular spots, situated at different points of the



circumference of the tube ; whereas that resulting from simple congestion is commonly diffused over a large extent of surface, or is confined to the most depending parts. Another important trait is to be derived from the condition of the abdominal vessels. In inflammation, the distended capillaries seem as it were lost, or, in other words, cannot be traced to any particular trunk ; the reverse of which obtains when the redness is cadaveric, or caused by mechanical obstruction. The blood, too, in the former case, cannot be pushed about so easily from one place to another, from the great firmness with which it is impacted in the minute vessels, added, perhaps, to some preternatural viscosity of its fibrin, or to the abstraction of some of its aqueous principles. For the same reason, also, maceration produces its effects much more slowly than in the sound state, and minute injections seldom succeed so well, many of the vessels giving way in consequence of the difficulty of displacing their contents. These characters are not, of course, so well marked in incipient as in confirmed inflammation ; nevertheless they almost always exist to a greater or less extent.

Besides these diagnostic signs, the mucous membrane, when inflamed, is always decidedly opaque, from the engorgement of the capillary vessels, which exhibit the appearance of a fine network, more distinct generally at the adherent than at the free surface of the mucous tunic. In the healthy state, on the contrary, or even when there is a slight degree of congestion, such as occurs during chymification, the membrane is diaphanous, or at least very nearly so ; and if a portion of it be detached, and held before the light, it will be found to be of a uniform rose tint.

The inflamed part offers considerable diversity in regard to the mode of its vascularity. Most commonly, it is *arborescent*, the vessels being spread out like the branches of a tree. (Pl. V, Fig. 3.) This species of injection, however, is never indicative of high inflammatory action, unless when conjoined with softening of the mucous tissue, or deposition of lymph upon its surface. Hence it either soon disappears, without producing any appreciable symptoms, or it loses its dendritic arrangement, and becomes capilliform. A fine example of the present variety of vascularity is often to be noticed in the conjunctiva, when, from any transient cause, its minute vessels are made to convey red blood.

The *capilliform* injection (Pl. V, Fig. 4), always denotes, as just intimated, a much higher grade of irritation than the dendritic, to which it succeeds. In this variety, the capillary vessels, excessively crowded with blood, intersect each other in such a manner as to form a most intricate network, often particularly conspicuous round inflamed ulcers, the isolated follicles, and the glands of Peyer. It is attended frequently with softening of the subjacent cellular tissue, and can be completely removed by maceration in water for twenty-four hours.

Either alone, or conjoined with one or another of the preceding varieties of vascularity, we occasionally find a singularly *speckled* appearance of the mucous membrane. (Pl. V, Fig. 5.) When the dots are numerous, the affected surface looks very much like the section of an inflamed brain. It may also be imitated, with great nicety, as has been observed by Andral and Hope, by scattering fine grains of powdered vermilion upon a moist sheet of white paper. The appearance is much more frequent in the stomach than in the intestines, though at times it is found in nearly every membrane of the body. I have seen it, in the same individual, in the pleura and pericardium, the stomach and bowels, the spleen, mesentery, and omentum. The specks, sometimes very closely set together, vary in diameter from the smallest pin-head to that of a

mustard-seed, and in color from a light rose to a deep cherry red. This species of vascularity, which does not point out an intense degree of irritation, uniformly proceeds from slight extravasation of blood, caused by the rupture of a considerable number of capillary vessels, in consequence of the impulse with which the fluid is forced into them at the onset of the inflammation. When it is conjoined, as very often happens, with the diffused redness, the dots generally occupy a considerable extent of surface, and occasionally run into each other so as to give the part a striated, streaked, or linear disposition.

In the highest degree of inflammatory action, as in that, for instance, resulting from the administration of some of the acrid poisons, spots of extravasated blood, of considerable magnitude, are not unfrequently met with. (Pl. V, Fig. 6.) In such cases, the fluid seems to be poured out originally into the submucous cellular tissue, whence it extends into the proper villous membrane, forming patches of a dark livid hue. Dissection does not always reveal the true cause of these extravasations. Very frequently they can be traced directly to one or more ruptured vessels; in many cases, however, the capillaries of the part seem to be in a state of the most perfect integrity: how far, under these circumstances, we are authorized to ascribe the phenomenon in question to simple vascular exosmosis, it is not easy to determine. Judging from what we observe upon the free surface of the mucous and other membranes, where blood is often thrown out in considerable quantities, without any laceration of the vessels, it is not unreasonable to conclude that the ecchymoses here adverted to occasionally have a similar origin.

This blood-shot appearance, indicative of the most intense irritation, is often attended with thickening and softening of the villous tunic, together with a deposition of lymph upon its free surface, an effusion of serosity into the subjacent cellular tissue, and the secretion of an inspissated and tenacious mucus, or even of purulent matter.

The brown, slate, and black color, with their various intermediate shades, are usually ascribable to a process of chronic irritation, or to inflammation of long standing. They are seen, however, occasionally in cases of a high degree of acuity; in such, for instance, as result from corrosive poisons, violent diseases of the bowels, and the more severe forms of bilious fever of warm climates. The black color is often witnessed in protracted diarrhœa and dysentery, and is always characteristic of profound morbid action.

An interesting question here arises, can an inflammatory redness exist, and yet wholly disappear after death? Bichat and Broussais, together with some others, think that it may; and, as the doctrine is of much importance, from the dangerous use which may be made of it in pathology, it demands a brief examination in this place. Those who have advocated the possibility of this occurrence, have adduced the fact, that in many cases the traces of erysipelas will greatly diminish if not entirely disappear after death; and the same circumstances, it is well known, are often observed with respect to the redness of tonsillitis, and other inflammatory affections of the throat. This condition has been explained by some on the assumption that the injection of the capillaries ceases as soon as the irritation causing it becomes extinct; whilst others have endeavored to account for it by supposing that, during the agonies of dissolution, the vitality of the affected part is so much diminished that it has no longer the power of attracting the blood in preternatural quantity. In regard to cutaneous diseases, this is unquestionably true; but, even here, cadaveric pallor of parts previously inflamed is far from being a general phenomenon, the redness oftentimes remaining long after death, especially in high grades of erysipelas, in scarlet fever, in measles, and in old irritable ulcers.

But is this comparison strictly applicable to the mucous coat of the stomach and bowels? Much as the skin and lining membrane of these hollow organs are related to each other by similarity of structure and function, and intimately as they are associated by sympathy, it is well known that their capillary injection is widely different under inflammatory irritation. Even in the highest grade of erysipelas, the blood can be easily enough forced out of its vessels, so as to give the part a pallid aspect, but nowhere can this be done, so far as we have opportunities of observing the fact, in confirmed inflammation of the mucous membrane. Pressure to a highly-irritated tonsil, or to a prolapsed rectum, never displaces the sanguineous fluid to so great an extent as in the skin, because it is impacted much more firmly into the minute vessels, the coats of which will often yield rather than allow their contents to pass along them.

Nor is this all. The blood has not that natural tendency to recede from the mucous membrane during the last struggles of life that it has to recede from the skin: on the contrary, so far from this being the fact, we uniformly find the fluid accumulate in the interior of the body; and, in many instances, if indeed it does not occur always, there is reason to believe that this process goes on for some time after the heart has ceased to act, and the vital principle fled. The redness, therefore, of the inflamed membrane, so far from diminishing on the approach of death, would have a tendency rather to become heightened; and this, indeed, may occasionally happen; though, taking all the facts which have been adverted to into consideration, I would be disposed to assume, as a general proposition, that the color remains precisely what it was during life.

Yet, although this subsidence does not take place in the generality of cases, it may, nevertheless, occur under certain circumstances. Thus, a high degree of irritation accompanied with deep redness, may exist in the lining membrane of the stomach; but a severe dysentery supervening, a powerful revulsion will be the result, in consequence of which the original disease, with its attendant vascularity, will in great measure subside; so that, on inspection, no trace whatever of gastritis shall be discernible. The same circumstance may occasionally occur in persons that are cut off in the course of a few hours, by violent attacks of cholera morbus. In several instances of this kind, where, from the intensity of the symptoms, no doubt could be entertained whatever of the existence of the most severe inflammation, I have not been able to detect the slightest vascularity of the mucous membrane after death. Life, in such cases, seems to be destroyed by some lurking poison, exerting its baneful impression peculiarly upon the nervous system, without leaving any visible alteration in the organs whence it radiates its influence.

Enough, surely, has been said to enable the reader to distinguish the different kinds of inflammatory redness, not only from each other, but also from that which appertains to the mucous membrane in the normal state. As the discussion of this subject has been carried to considerable length, I shall content myself, in concluding this article, with a brief analysis of the other anatomical characters which are to be found, either alone or conjointly with this discoloration, in the acute variety of gastro-enteritis. These, it will be remembered, consist in opacity, thickening, softening, vesicular eruptions, and vitiated secretions.

One of the earliest effects, in addition to the alteration of color, of acute inflammation of the mucous membrane, is a diminution of its natural *transparency*. Even when there is but a slight degree of redness, the irritated spots lose, in great degree, their diaphanous aspect; but, should the discoloration



be deep and uniform, the opacity will be complete, owing to the extreme injection of the capillary vessels.

At the onset of the disease, the secretion of the membrane is somewhat augmented in quantity, but thinner and less viscid than in the normal state; the mucous follicles are also perceptibly engorged, and more prominent than usual, being encircled by a beautiful vascular wreath. When the inflammation is at its height, the secretion is almost suppressed, and the membrane consequently dry, as happens in inflammation of the Schneiderian lining of the nose; but, as this period is always of short duration, the secretion is soon re-established, and often discharged in considerable abundance, being of a thick, ropy consistence, and of a greyish opaline color; occasionally, also, it is of a greenish tint, or dark and sanious. The orifices of the mucous follicles are enlarged and patulous; and if, under these circumstances, the membrane be carefully washed, it will be found to exhibit a granulated aspect, not unlike a pale fungous ulcer. Towards the decline of the disease, the secretion sometimes assumes a puriform character, and is often quite copious, — a phenomenon which was long ago adduced by John Hunter and his disciples, as exemplifying suppuration without solution of continuity.

*Dryness* of the mucous membrane, as a result of inflammation, is much less usual than in some of the other textures of the body. The phenomenon is by no means uncommon, for instance, in the arachnoid tunic of the brain, and is always indicative there of a very intense degree of irritation. The same circumstance is occasionally witnessed in the alimentary tube, and sometimes to a very considerable extent. Thus, in a case mentioned by Professor Horner, the whole cæcum was so dry as to be almost crisp, like a bladder that has been suspended for some time in the air. Most commonly, however, this lesion occurs in small spots, from one to six lines in diameter.

The surface of the inflamed membrane loses much of its natural softness; it becomes rough, from the turgid condition of its villousities and follicles, and, in very intense cases, it is not unusual to find it chapped, cracked, or fissured.

Increase of *thickness* is a pretty constant attendant on acute inflammation, the tumefaction appearing either cotemporaneously with, or soon after the redness. Effusion of sero-albuminous matter into the submucous cellular tissue, added to injection of the capillary vessels, seems to be the main cause of this anatomical character, which is never so well marked in the stomach and bowels as in the larynx, conjunctiva and fauces. Occasionally, the thickening proceeds almost wholly from the mucous follicles, which may be so much enlarged as to give the surface of the affected membrane, as already stated, a rough, granular appearance.

At an early period of the attack, the density of the membrane is commonly somewhat augmented; but, in its progress to its height, as well as during its decline, it is always *preternaturally softened*. In this condition, which is deserving of much attention, both the mucous and sub-mucous textures are frequently infiltrated with serum, muco-purulent matter, and even with blood; at the same time that they become so pulpy and disorganized as to allow themselves to be scraped away with the finger-nail or the handle of the scalpel. Inflammatory softening, as will be shown hereafter, is much more common in some parts of the alimentary tube than in others, and what is remarkable, is seldom attended with any decided redness, the part, which is opaque, and elevated, having every appearance as if the blood had ceased to penetrate it for some time prior to the extinction of life. Thus, then, whenever the irritation is of a high grade, the submucous cellular tissue uniformly participates in the disease.

A singular *vesicular eruption* is sometimes met with in this disease. It is indicative of the very highest grade of inflammatory action, and has hitherto been noticed chiefly in dysenteric affections and Asiatic cholera. The eruption consists in the development of minute spherical vesicles, very little elevated, but discharging, when punctured, a small quantity of clear limpid fluid. Their walls are perfectly transparent, and few of them exceed the diameter of a grain of mustard. Very often these vesicles occur in thick clusters, hundreds of them being found upon the surface not larger than a square inch.

No part of the alimentary tube seems to be exempt from this eruption. It is observed, however, by Professor Horner, who has repeatedly witnessed it in Asiatic cholera, that it manifests a peculiar predilection, so to speak, for the valves of the jejunum, along the roots of which it is sometimes perfectly confluent, like the eruption of small-pox. In the ileum and colon, they are more scattered, and consequently much less numerous. Dr. Abercrombie has seen the whole surface of the large bowel thickly covered with these vesicles.

Generally this vesicular eruption is associated with a chapped or excoriated condition of the mucous membrane, preternatural vascularity, deposition of lymph, and effusion of sero-albuminous, bloody, or purulent matter. How it is produced, it is not very easy to determine. I cannot agree with Professor Horner, in supposing that they consist simply in an elevation of the epidermis of the stomach and bowels, for the obvious reason that no such structure as that exists; it is much more reasonable to conclude that it is formed directly by the mucous corion itself, in consequence of some specific inflammatory irritation, not unlike what we see in erysipelas and anthrax. The subject, however, is still open for discussion, and will no doubt receive the serious attention of pathologists.

We now come to the consideration of *lymph exudations* (Pl. V, Fig. 7), as signs of inflammatory action. In the stomach and bowels, the deposition of this substance is much less frequent than in the supra-diaphragmatic portion of the alimentary canal. In children, the mouth, pharynx, and œsophagus are sometimes completely lined with it; but even in them it is far from being common, and seldom extends along the rest of the digestive tube. In attestation of the truth of this remark, it will be sufficient here to state, that out of two hundred and fourteen cases of aphthous disease that occurred in 1826, in the Foundling Hospital of Paris, Billard noticed only three in which there were false membranes in the stomach, and only two in which they existed in the intestines.

After puberty, these exudations are equally uncommon, as well in the stomach as in the intestines; but much more so in the former than in the latter of these organs. In the stomach, I have witnessed this phenomenon only in a few instances, but in the rest of the alimentary tube repeatedly, both in children and in adults. By Dr. O'Brien and Dr. Cheyne, of Dublin, it is described as a frequent appearance in the epidemic dysentery of Ireland; and by numerous observers, such as Horner, Ferris, Corbyn, Gendrin, Gerardin, and Gaimard, it has been noticed in Asiatic cholera. This exudation is of very common occurrence in the large intestine of persons who die of dysentery and bilious fever in the Western States. I have noticed it in a very great number of cases, in every part of the tube, but more particularly in the rectum, and ascending portion of the colon. The ileum is also frequently affected in these diseases, but I have never observed the exudation extend into the jejunum, duodenum, or stomach.

The inflammation giving rise to this lymphic exudation appears occasionally to assume a sort of epidemic type. Of this, Dr. Gendrin makes mention. In the spring of 1817, an abdominal phlegmasia, as he informs us, prevailed extensively in Paris, in which nothing was more common than to see pseudo-membranous matter discharged both by the mouth and anus. In most of the patients who were admitted into the wards of the Hotel-Dieu, the inflammation, especially during the decline of the epidemic, commonly affected at first the stomach and small bowels, from whence it gradually descended into the colon and rectum. In a large proportion of those who died of this disease, the pyloric half of the stomach was covered by an adventitious membrane, and the whole gastro-enteric lining of an erythematous red color. The mucous corion was sensibly thickened as well as softened; and, in many places, there were small brownish-looking zones, likewise studded with albuminous matter.

The membranous exudation usually takes place, in the first instance, in small whitish specks, separated by considerable intervals; these, gradually coalescing, form large patches; and these, again, continuous lamellæ, which often cover a very great extent of surface. A few years ago, I met with a specimen, in a young man who died of acute enteritis, after an illness of two weeks, in which nearly the whole of the lower half of the ileum was lined by a false membrane, in many places fully half a line in thickness: it adhered with considerable firmness to the surface beneath, which was extensively fissured, and of a dark, gangrenous color. The patient, in this case, suffered under all the symptoms of the most intense inflammation.

Is this substance susceptible, when thrown out upon the surface of the stomach or bowel, of becoming organized? Upon this subject the opinions of anatomists can scarcely be said, in any way, to accord. Gaimard and Gerardin, two Russian physicians, affirm that, in cholera subjects, they have several times seen the finest capillary vessels shooting into it from the natural membrane; but no other writers, so far as I know, have been so fortunate. That the thing is possible, may be readily supposed from what occasionally happens in the larynx, the womb, and urinary bladder: that it is extremely infrequent, must be equally plain, especially when we take into consideration the heterogeneous contents of the alimentary tube, and the tendency which they would have to thwart a process of such delicacy and refinement. Whether organized, however, or not, the adventitious membrane is always sooner or later detached, either in small semi-concrete masses, or, as sometimes happens, in long, tubular pieces.

I will not stop here to discuss the question, agitated by some highly respectable pathologists, whether these exudations are the result of a peculiar disease, the essential nature of which is still unknown, or whether they are the effect simply of acute inflammation. I will merely observe that it is a well-ascertained fact, that such depositions are never present without some of the phenomena which indicate the existence of phlegmasial disturbance. Nay, indeed, it can scarcely for a moment be supposed that the mucous membrane, either of the alimentary canal, or of any other part of the body, could pour out lymph-like matter, and yet not be inflamed. Standing in the light of cause and effect, the thing is impossible.

Should any one be disposed to deny this, let him remove this lymphic exudation, and carefully inspect the natural membrane. He will find, as might be anticipated, that the affected part is highly vascular, reddened, thickened, more or less softened, chapped, or perhaps even excoriated; the villousities, of a deep crimson hue, are turgid with blood; the follicles enlarged and prominent; and the submucous cellular texture weakened and extensively infil-



trated with serous or other fluids. Thus have we not only the anatomical characters of acute disease, but of the most intense inflammation.

When acute inflammation runs so high as to give rise to bloody infiltrations beneath and within the substance of the mucous coat, or even to small ecchymoses, it occasionally terminates in *purulent effusions*. Under such circumstances, it is by no means rare to meet with considerable abscesses, either in the walls of the digestive passages, or in the contiguous portions of the mesentery, produced by an extension of the irritation, and opening most generally into the bowel. The mucous membrane thus bathed and infiltrated with pus, is commonly of a reddish grey color, very soft, and yielding, being sometimes wholly disorganized, and converted into a dirty-looking, pultaceous substance. Frequently, considerable quantities of pus are thrown off by the inflamed tunic, without any solution whatever of continuity. Rarely does it come away pure, but is almost always mixed with vitiated mucus, bloody, and fecal matter.

*Blood*, either pure or mixed with the mucous and other contents of the alimentary tube, is oftentimes thrown out in violent attacks of this disease. This exhalation, for such in truth it generally is, is almost constantly present in dysentery and yellow fever, both of them high grades of inflammation, affecting, in the one case, the mucous coat of the colon, in the other, the mucous coat of the stomach. No doubt can be any longer entertained that the matter of black vomit is merely a transudation of blood, altered in its physical and probably also in its chemical properties, by contact with the gastric acid. That it is a secretion from the vessels of the stomach, is an opinion which was promulgated by the late Dr. Physick, during the yellow fever in Philadelphia, in 1798, and which is the conclusion now generally embraced by the medical profession in different parts of the world. The quantity of this singular looking matter, once supposed to be nothing but vitiated bile, is sometimes excessively great; and yet, upon examination, no structural lesion whatever, excepting lymph exudation, and perhaps softening of the mucous membrane, is to be found in the organ which is its seat.

The changes which the blood experiences, when brought in contact with the acid and gaseous contents of the stomach and bowels, are curious and important. When thus effused, the fluid is speedily deprived of its natural color, and converted into a soft, black substance, resembling thin pitch. (Pl. V., Fig. 8.) Very much the same appearance is sometimes observed when the blood becomes stagnant in the villous and follicular structures of these organs, from the influence, probably, of the same cause. This discoloration will be much greater always, there is reason to suppose, in proportion to the quantity and vitiated condition of the gastric juice. Hence the reason, perhaps, why it generally has that peculiar coffee-ground appearance in yellow fever.

Thus, then, an exhalation of blood, either pure or variously altered by the gastric contents of the alimentary tube, is another effect of acute inflammation of the mucous membrane, and this by no means a rare one. The redness which accompanies it is generally patch like or diffuse, and not unfrequently there are considerable-sized ecchymoses. Conjoined with these appearances, may be softening, excoriations, and thickening of the villous tunic, with vesicular eruptions and deposits of lymph. It may be observed here, that it does not necessarily follow, when abrasions exist on the mucous coat, that the blood has issued merely from them. Very often, indeed, there is reason for believing that they have nothing at all to do with the hemorrhage.

Produced by the same process is the thin *rice-water secretion*, which forms so prominent a feature of Asiatic cholera and violent diarrhœa. The essential character of this secretion is sero-albuminous, and the quantity poured out is

often very great, several quarts being occasionally discharged in the course of a few hours. For the most part, the fluid is inodorous, whitish, and of an aqueous consistence, with numerous flakes of lymph floating through it, which frequently impart to it a turbid, milky aspect; in diarrhœa, it is seldom so pure as in cholera, and it is also more apt to be offensive, from the union of feculent matter and vitiated mucus. It is partly coagulable by heat, alcohol, and acids.

The most prominent lesions connected with this sero-albuminous secretion are, softening of the villous membrane and hypertrophy of the follicles, with occasional depositions of lymph. What is remarkable, there is sometimes a complete absence of redness of the lining membrane, both of the stomach and bowels, a circumstance which may be satisfactorily accounted for, by supposing that the immense rice-watery discharges relieve the vascular engorgement prior to dissolution, so that, upon inspection, no discoloration whatever is perceptible.

The function of *absorption*, so vigorously carried on by the mucous membrane in the normal state, is generally much diminished, sometimes totally suspended, in acute inflammation. Gendrin, to satisfy himself concerning this interesting circumstance, repeatedly applied poisonous substances, such as strychnine and prussic acid, to the mucous membrane of the nose and vagina of animals, in which these tubes had been previously irritated by tincture of cantharides and other fluids, and he invariably found that no injurious results were manifested by their contact. He farther ascertained that the more corroding poisons produced their specific effects only after they had wrought their way through the inflamed textures to which they had been originally applied.

In addition to this interruption of the absorbent faculties, there is almost always, when the inflammation runs high, a suspension of the digestive process, so that if food be taken into the stomach it will either immediately be thrown off by vomiting, or it will pass into the bowels, and be finally evacuated by stool. Highly interesting as these facts are, in a physiological point of view, they are still more so in a practical light, as showing the extreme folly of employing any but the very blandest kinds of food and drink in the treatment of gastro-enteric diseases. It is to a knowledge of them, doubtless, that Broussais and his followers are mainly indebted for the success which is said, in France, to characterize the exhibition of diluents in phlegmasial disorders of the stomach and bowels, in the almost total absence both of medicine and food.

Inflammation of the lining membrane of the alimentary tube frequently produces, even when it is entirely confined to the mucous corion, a well-marked injection in the other tunics. When the disease is very extensive and intense, the vascular injection may not only pervade the whole thickness of the stomach, small or large bowel, but even reach to the mesentery. Under such circumstances, the distended state of the neighboring vessels, the purple discoloration and arborescent appearance of the peritonæal covering, either alone or in conjunction with globules or flakes of adherent lymph, generally afford abundant evidence of the probable extent of the internal lesions. The mesenteric glands are sometimes swelled and inflamed, though seldom so much as in ulceration.

In active inflammation, the digestive tube is ordinarily dilated; which, however, continues only so long as the irritation is limited to the mucous lining; for as soon as it extends to the muscular tunic, the canal becomes invariably contracted; sometimes to so great a degree as to render it impracticable to evacuate its contents.

One of the most singular circumstances connected with acute inflammation of the digestive passages, is the development of gas which we occasionally

meet with. This phenomenon has been variously explained by different pathologists ; some supposing that it arises merely from a species of fermentation of the fluids which may be contained at the time in the stomach and bowels ; others, that it is the result of a peculiar secretion, the nature of which is unknown. Without denying the truth of these explanations, both of which are, perhaps, to a certain extent well founded, it may yet be doubted whether they are sufficient to account for the fact that this evolution of gas is present in some cases and absent in others. With a view of deciding this question, Gendrin irritated a portion of bowel in several dogs by caustic, alcohol, or boiling water, and then intercepted the inflamed part between two ligatures, having previously exhausted the air with a syringe. In two out of five of the animals thus treated, the gut was distended, in twelve hours after the operation, with an inodorous gas, the inflammation in both being rendered evident by the lively redness of the villous tunic ; in the other dogs, although the discoloration was equally conspicuous, and produced by the very same substances, no air whatever was to be found. Is it probable that this fluid is disengaged from the blood-vessels of the affected part ? This is not unlikely, when it is recollected that carbonic acid gas is evolved in great quantity from the same source, in the lungs during respiration.

It is not unfrequently found that the inflammation, instead of invading the villous texture, properly so termed, begins in and is confined exclusively to the isolated follicles, scattered in such profusion over the alimentary tube. In the inceptive stage of the disease, the affected glands look like little boils, moderately projecting beyond the level of the surrounding surface. (Pl. V, Fig. 9.) Varying in size from a small pin-head to a mustard-seed, they are generally of a spherical shape, soft, and of a reddish glossy aspect, each being marked by a minute, central aperture, indicating its natural orifice. At this period of the disease, the glands are already quite injected ; and, if they be closely examined, it will be found that they are encircled by a beautiful wreath of vessels, so fine as to be almost undistinguishable by the naked eye. At a more remote stage, their color is of a light brown ; their bulk is considerably augmented ; and their surface, instead of being lubricated, as before, by an abundant mucus, is nearly dry, their secretory functions being in great degree suspended. This state, however, soon disappears, and is followed by a copious flow of fluid. When, as often happens, the villous membrane between the follicles participates in the disease, it gradually loses its natural characters, and exhibits some of those appearances which have been pointed out as denoting acute inflammation. The glands themselves are often very much softened, or so greatly disorganized as to give the surface of the digestive tube a singularly cribriform aspect.

Not unlike the preceding are the changes which the glands of Peyer undergo in acute inflammation. (Pl. VI, Fig. 1.) In the normal state, these bodies, it will be remembered, are seldom very distinct ; when affected, however, by disease, they are rendered quite prominent, being considerably raised above the surrounding surface, in the form of elliptical, ovoidal, or circular patches, from a few lines to several inches in diameter. In this state, they are of a florid color, from the injection of their capillaries ; and their surface has an uneven, granular, or honey-comb appearance, from the projection of their follicles. The submucous texture is also considerably thickened, and the intervening membrane more or less altered, according as it participates or not in the inflammation. Ulceration often follows this process.

Acute inflammation, whether affecting the villous or the follicular textures, or both at the same time, may either terminate by resolution, or it may pass



into the chronic form, or else proceed to disorganization. When it goes on favorably, the infiltrated fluids are gradually absorbed; the vascularity diminishes; the natural secretions are restored; the absorbing faculties become more and more vigorous; and, at length, the functions of the part are entirely re-established, — the only alterations which remain being a thickened, and occasionally a slightly indurated state of the mucous and submucous textures. If the follicles have been mainly involved, the affected surface exhibits, after the lapse of some time, numerous dark dots, which have been compared, not unaptly, to those of a newly-shaved beard.

With regard to acute inflammation, it may be observed, in conclusion, that its relative frequency is much greater in some parts of the alimentary tube than in others. The inferior half of the ileum, the stomach, and the commencement of the colon, are, without doubt, most commonly engaged, either alone or conjointly. This latter circumstance has given rise to the term *gastro-enteritis*, in such frequent use amongst the French pathologists, but which is not always applicable, inasmuch as the coincidence is by no means universal, or even perhaps general.

Although acute inflammation occasionally terminates in *gangrene*, yet this effect is by no means so common as was at one time supposed by pathologists. By a reference to the works of the older anatomists, it clearly appears that they were constantly in the habit of confounding high discoloration, whether proceeding from simple congestion, effusion of blood, or melanotic deposition, with mortification of the mucous texture. Since, however, a more accurate method of investigation has been introduced into science, it has been abundantly established that this lesion is of very rare occurrence, being scarcely met with in one case out of ninety-nine of gastro-enteric disease. This remark

#### EXPLANATION OF PLATE VI.

Fig. 1, p. 555; inflammation and ulceration of one of the glands of Peyer. The part is very red, from the injection of the capillary vessels, and presents a full, tumid appearance. The edges of the ulcer are straight and not very high, and the bottom is formed by the muscular fibres of the ileum.

Fig. 2, p. 557; mucous membrane in a state of gangrene. Some parts are of a red scarlet color, others black, and there is also a spot which is incrustated with lymph.

Fig. 3, p. 557; in this figure, the gangrene is at its height; the mucous membrane is of an almost uniform black color, and there is no appearance of any vessels.

Figs. 4, 5, p. 559; these figures illustrate the effects of chronic inflammation, particularly as they occur in the large bowel.

Fig. 6, p. 559; hypertrophy of the isolated follicles, and discoloration of the mucous membrane, the results of chronic irritation.

Fig. 7, p. 561; softening of the mucous membrane of the stomach from inflammation. The vessels are seen ramifying through the submucous cellular tissue, and present the appearance as if they had been flattened.

Fig. 8, p. 562; softening from the effects of the gastric juice. The mucous membrane is of a paler color than in the preceding figure, and in one part there is a large perforation, followed by an escape of the contents of the organ.

Fig. 9, p. 567; ulcer of the mucous tunic of the stomach in a state of cicatrization. The part has a bluish, corrugated appearance, and the reproduction of the original textures is only partial.







Plate 17.

Fig. 1



p. 355

Fig. 2.



p. 357

Fig. 3



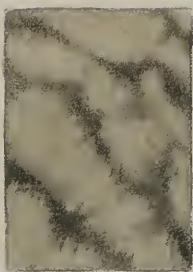
p. 357

Fig. 4



p. 359

Fig. 5



p. 359

Fig. 6



p. 359

Fig. 7



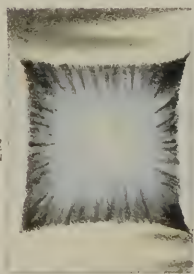
p. 361

Fig. 8



p. 361

Fig. 9



p. 367



applies, of course, solely to the idiopathic variety of inflammation, and not to that which is occasioned by strangulation, intussusception, external violence, or corroding poisons.

It is now well ascertained that some parts of the mucous membrane of the alimentary tube are much more liable to gangrene than others. The inferior half of the ileum is the section most commonly affected, and next in point of frequency stands the colon, particularly the ascending portion. It is an extraordinary fact that the stomach, jejunum, and duodenum are seldom implicated. Why these reservoirs should enjoy this remarkable immunity, both from this and some other affections, has never been explained.

Large portions of the mucous membrane are sometimes deprived of their vitality. Professor Horner refers to a case in which the gangrene implicated nearly the whole, both of the small and large bowel; and, in several instances which have come under my own observation, I have seen the greater portion of the ileum and colon involved. But, generally, the lesion is much less extensive, occurring in small patches, of an irregular shape, and from one to several inches in diameter. The textures primarily affected are, the mucous and follicular, from which the disease may gradually spread to the other tunics, converting them into soft, dark-colored sloughs, incapable of resisting the slightest distention from fecal matter. Hence it not unfrequently happens, if the patient lives sufficiently long, that the intestinal tube gives way in one or more places, and discharges its contents into the abdominal cavity, as in perforation from ulcerative action.

The color of the sphacelated part is variable. (Pl. VI, Figs. 2 and 3.) Occasionally we find it of a dark-drab, dirty-ash, or greenish tint; more commonly it is of a mahogany-brown, black, or livid, from the imbibition of the ichorous matter, which is often poured out in such abundance during the height of the inflammatory stage of the disorder. The mucous membrane which surrounds the slough is generally very considerably injected, and of a red mulberry color, indicative of excessive irritation.

With this change of color, the mucous membrane is considerably altered in its consistence, being so much softened, indeed, that it can be removed by simply passing over it the handle of the scalpel. In many instances, the gangrenous part is remarkably offensive: frequently it is covered with flakes of lymph, and occasionally, though this is very rare, there are little phlyctenæ, not unlike those which are witnessed in mortification of the skin and cellular tissue. An emphysematous condition of the submucous cellular tissue is also sometimes found; but this, in the majority of cases, is to be regarded rather as a result of putrefaction than of inflammation.

When the gangrene seizes upon the glands of Peyer, which, however, is not often the case, the sloughs are of a dark brownish color, soft and fetid, very much as in the preceding case; and, on being detached, deep excavations are formed, with loose, ragged edges. Although in the generality of cases these excavations do not extend beyond the submucous coat, yet occasionally they invade the whole thickness of the ileum, and thus give rise to perforation and fatal effusion. Sometimes, even when the gangrene stops short at the mucous and subjacent cellular textures, considerable blood-vessels, branches of the mesenteric arteries and veins, are laid open, and the patient falls a victim to hemorrhage. Appearances very similar to these are observed when the gangrene invades the isolated follicles, except that the surrounding parts are usually less red and injected.

I shall close this subject with the following case, which came under my notice about eighteen months ago. A colored man, twenty-seven years old,



of a stout, athletic frame, was affected for three days with all the symptoms of a severe bilious colic. At the end of this period, when I saw him in consultation, the tongue and extremities were quite cold, the pulse almost imperceptible at the wrist, and the stomach excessively irritable, with a constant disposition to vomit, intense thirst, and a countenance expressive of the most intense distress. The abdomen was tympanitic, and the bowels, although perfectly torpid, were almost free from pain. In this condition, the patient continued for about forty-eight hours, when there was an appearance of slight reaction, though still no evacuation from his bowels. In a short time, however, the symptoms again became worse, and he expired, in a state of complete collapse, on the seventh day from the attack.

On examination, the great omentum, excessively loaded with fat, was found glued to the colon and right side of the abdomen, the points of attachment being in a black, fetid, gangrenous condition. The mesentery and small bowel were gorged with dark blood, and the latter adhered extensively to the bladder and rectum by a thick mass of lymph. The cæcum, vermiform appendage, and inferior fifth of the ileum were externally of a livid color, and internally black in patches from one to two inches in diameter. Here and there, the surface of the mucous membrane was covered with flakes of lymph, and the same substance was found in considerable abundance upon the exterior of these portions. The whole intestinal tract was much distended with gas and feculent matter; and the stomach, which contained about a pint of thin, greenish liquid, presented well-marked signs of inflammation, especially at the great tuberosity. All the other abdominal viscera were natural.

*Chronic inflammation* of the mucous membrane of the alimentary tube is much more frequent than acute, of which it may be either the consequence, or it may exist as an original and independent disease. It is very common in dyspepsia, diarrhœa, dysentery, and infantile cholera, of which and of almost all protracted fluxes of the bowels, it is the principal cause, these affections themselves being merely the symptoms. Though not so immediately dangerous as acute inflammation, this disorder is usually very difficult to be dislodged, from the strong hold which it takes of the part, and from the insidiousness of its attack, weeks, nay months sometimes elapsing before it induces any decided constitutional disturbance.

The anatomical characters of chronic inflammation differ, in many essential points, from those of the acute variety of the disease. As a general proposition, it may be stated that the appearances vary according to the duration of the malady, and the nature of the exciting cause, together with several other circumstances which it is unnecessary to specify. Thus, when the disease is of recent standing, we usually find the mucous membrane of a dusky red, inclining to mahogany; whereas, in the opposite state, especially when the attack is one of considerable intensity, it is of a livid, purple, or mulberry aspect. Though occasionally the discoloration is diffuse and uniform, yet in the great majority of cases it occurs in small patches, stripes, or bands, leaving the intervening surface of the natural hue. As in the acute form of the disease, so in this, the color, whatever be its nature, is closely identified with the mucous texture, and therefore always removable with much difficulty by maceration; artificial injection, also, is no longer practicable, at least to any degree of minuteness. The vessels upon which this discoloration depends are generally disposed in arborescent lines, and, what is remarkable, and serves to distinguish this from mere congestive vascularity, is, that they cannot be traced to any particular trunks, but seem as if they were lost in the midst of the inflamed tissues.

But it is not always that the diseased membrane is heightened in its color. Often, indeed, it is preternaturally pale, as if it had been bleached and drained of its fluids, and in such cases, also, it is generally very flabby and relaxed. Examples of this kind have been reported by Andral and Louis, and have repeatedly been witnessed in my own dissections: they occur with considerable frequency in chronic diarrhœa and in infantile cholera.

A very common appearance in this disease is a slaty bluish or blackish discoloration, occurring in spots, from the size of a five cent piece to that of a dollar. (Pl. VI., Figs. 4, 5.) The parts in which it is most frequently met with are the colon and the rectum, where it is sometimes diffused over a large extent of surface. In the stomach and small bowel, where it is usually more limited, it is commonly most distinct along the temporary folds and winking valves, for what reason it is not easy to say. The discoloration which runs through a great variety of shades, from a light slate to a jet black, is seldom witnessed except in cases of long standing, or in such as are characterized by a considerable degree of intensity, and it probably always results from an extravasation of blood into the submucous cellular texture. Its seat, however, is not, as might be supposed, confined to this substance: often, indeed, it involves in a special manner the mucous membrane, the follicles, and even the villousities; and cases are not wanting, though they are uncommon, in which it penetrates all the tunics at the same time, tinging the tube externally of a greenish, brownish, or sooty dye.

In chronic inflammation, the substance of the mucous membrane is generally thickened, and its density augmented, so that it can no longer be torn with the same facility as in the normal state. The mucous follicles (Pl. VI, Fig. 6) are also more or less enlarged, forming, in many instances, hard, granular bodies, which project considerably above the level of the surrounding parts. Nor is the hypertrophy — for such it really is — always confined to these structures. The villousities, small as they naturally are, are often involved in the disease, and sometimes attain quite an astonishing development. Owing to these alterations, the surface of the mucous membrane is usually rough, and occasionally even cellulated, like a honey-comb. This, however, is by no means a uniform occurrence; for cases are frequently witnessed, and even those of long standing, in which the part is perfectly smooth and polished, not a gland or villosity being any where perceptible.

When, as sometimes happens, the disease passes into the acute form, the mucous texture undergoes still further changes, or, more correctly speaking, it assumes very different characters. It loses its hardness and tenacity, and is converted into a soft, thick, pulpy substance, which is infiltrated with various kinds of fluids, such, for example, as serosity, pus, or blood, either alone, or in combination. If the morbid action be of long continuance, the mucous tunic is apt to give way, and to form ulcerations, which extend, by degrees, to different depths in the tube. If, on the other hand, the disease retrogrades, the membrane, although it loses its dark complexion, remains preternaturally soft, spongy, and tumid.

In chronic as in acute inflammation, the vessels of the part always retain their unnatural volume for some time after the main disease has subsided; and cases are occasionally observed, in which the veins have quite a tortuous and varicose disposition, forming thick whirls underneath the mucous tunic. This appearance is particularly liable to attend chronic inflammation of the stomach, colon, and rectum.

Another effect of chronic inflammation is an enlargement of the muciparous follicles, from partial or complete obliteration of their orifices, and the

consequent retention of their secretions. In this manner *encysted tumors* are formed, from the size of a millet-seed to that of a pea. They are isolated, or grouped, transparent, elastic, rounded, or ovoidal in their shape, embedded in the submucous cellular tissue, and raised above the level of the villous membrane. Their surface is often pervaded by minute straggling vessels, the red color of which beautifully contrasts with the white appearance of the enlarged gland. Their contents are usually thick and glairy, like the white of eggs, but sometimes they are watery, or of a pultaceous consistence, like that of porridge or soft boiled rice. In old cases, the walls of these cysts are occasionally opaque, speckled, and transformed into a tough fibrous tissue.

The most common seat of these tumors is the large bowel, but they may occur in any portion of the sub-diaphragmatic portion of the alimentary canal. They are much less common in the human subject than in the horse, in which they may acquire the volume of an egg, or even an orange. Dupuy has found similar bodies in dogs, sheep, and pigs.

On some occasions, fungous excrescences are to be noticed, hanging from the free surface of the membrane like so many little warts; and nothing is more common than to find the submucous cellular tissue indurated and hypertrophied. But of these lesions, as well as of ulcerations, we shall speak more particularly in the following pages, under the head of organic diseases, which will presently engage our attention.

The secretions in this disease present several important varieties. Most generally they consist of a thick, ropy, inodorous mucus, discharged in considerable quantity by stool; not unfrequently, however, they are of a thin, gleet-like nature, and the cases are not uncommon wherein they are serous, sanious, purulent, or fibrinous. Occasionally, again, though this is rare, the evacuations are thin, greasy, and of a singularly cadaverous smell.

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### SECTION III.

#### OF SOFTENING OF THE GASTRO-ENTERIC MUCOUS MEMBRANE.

*Softening* of the mucous membrane of the alimentary tube, a subject already incidentally referred to in the preceding section, was first described, as a distinct pathological condition, in 1826, by Dr. Louis, of Paris. Since that period, the disease has attracted the attention of numerous observers both in Europe and in this country, and, as might be expected, our knowledge concerning its anatomical characters, however deficient it may be in relation to its symptoms, is already of a high order.

Softening of the mucous texture from inflammation, that variety to which we shall at present restrict our remarks, is most commonly noticed in the lower third of the ileum, the cæcum, the right and left portions of the colon, the stomach, and the rectum, the frequency of its occurrence being very nearly in the order here enumerated. In the majority of cases, it is confined to particular parts of the digestive tube; but, in some rare instances, it extends through its entire length, from the cardiac orifice to the anus. Although the softening seems to be occasionally limited to the mucous corion, villousities, or follicles, yet most generally it occurs in all these structures at the same time, converting them into a pulpy, homogeneous substance. Under certain circumstances, it is supposed to be capable of invading all the tunics of the



stomach or intestines, proceeding successively from the mucous membrane to the subjacent cellular texture, and from the latter to the muscular and serous layers, so as to give rise to perforations with a discharge of the contents of these reservoirs. This opinion, however, has been contradicted by some very able pathologists, under a belief, in all probability well-founded, that, when the lesion is thus extensive, it depends, not on inflammation, but on the chemical action of the gastric juice. The reasons for this belief will be more fully adverted to in the course of this article.

Inflammatory softening is usually somewhat gradual in its progress, running through several well-marked *stages* before it attains its full development. In the first stage, the mucous membrane is remarkably brittle, and breaks as soon as it is seized with the forceps, allowing itself no longer, as in the sound state, to be detached in small, narrow strips ; in the second, the cohesive powers are so far destroyed, that, by merely passing the finger over it, it may be converted into a soft, greyish pulp, very analogous to thick cream ; and, in the last stage, the disorganization is such that the mucous membrane may be easily removed by a small stream of water poured upon it from the height of a few inches. When the softening has attained this degree of development, it is not uncommon to find considerable portions of the mucous membrane detached, by the passage simply of the fluid contents of the alimentary tube ; and in this way may be produced numerous abrasions, of a circular, oblong, or linear configuration, from the size of a split pea to that of a dollar, or even the magnitude of the hand. The edges of these abrasions are generally clean and even, and their surface is formed by the submucous cellular tissue, which is itself often in a state of partial disorganization. The denuded patches, especially when small and circular, have occasionally the appearance of ulcers ; but, as has been remarked by Carswell, in all cases of doubt, the handle of the scalpel, carried lightly over the part, will enable us to determine their true nature. If the membrane sloughs away to a very great extent, as sometimes happens, the margins of the sore, instead of being rounded, as in the former case, will be irregularly bevelled off, and run insensibly into the surrounding parts. In cases of this description, too, it is not unusual to find shreds of the mucous membrane stretched across the denuded surface, so soft as to render it impossible to lift them with the forceps.

Considerable diversity prevails in respect to the *color* of the softened membrane, different shades of tint marking different cases, and even the same case in different regions. (Pl. VI, Fig. 7.) In the generality of instances, the membrane is of a pale bluish aspect, one or two degrees lighter than in the normal state ; and not unfrequently it is of a dead white, like milk or cream. This variety of softening is very common in consumption, in mesenteric disease, and in all affections attended with much emaciation.\* In other cases, again, the membrane presents various shades of red, brown, or purple, or perhaps, even retains its natural hue. Occasionally the discoloration is rigidly limited to the part affected, and this is especially the case in the pale variety ; but in most instances it extends to the neighboring parts, which at the same time exhibit all the phenomena of ordinary inflammation.

The blood-vessels in this disease have a singularly flattened appearance, and many of them are partially obliterated, no doubt from their participating in the softening. Injecting matter can no longer be forced into them, and

\* Carswell, London Cyclopædia of Practical Medicine, vol. x., p. 15.

their contents often escape so as to form small dark-colored ecchymoses, resembling the black spots observable in the stomachs of those who die of yellow fever.

The lesion now under consideration is exceedingly common, so much so, indeed, that I rarely make an examination without meeting with it. Although it is occasionally limited to some particular portion of the alimentary tube, yet, in by far the greater number of subjects, it occurs simultaneously in the stomach, the ileum, and large bowel. In some instances, it involves an immense extent of surface, one-third, a half, or even two-thirds, of the gastro-enteric lining. It may be the only disease, or it may exist with other affections, such as ulceration, extenuation, or thickening; but, however this may be, the anatomical characters do not differ from those we have just pointed out. Inflammatory softening of the mucous membrane is frequently witnessed in bilious and typhoid fevers, in dyspepsia, in phthisis and pneumonitis, in diarrhoea and dysentery. I have likewise noticed it repeatedly in infantile cholera, especially in the chronic form of that disease, of which it often constitutes the principal evidence. In nearly all the dissections which I have made of subjects who died of this malady, the softening was particularly observable in the mucous lining of the colon and stomach. In a few instances it was also noticed in the lower half of the ileum.

The *symptoms* of this disease do not differ materially from those of other gastro-enteric affections. Generally, with more or less protracted indisposition, there are epigastric pains, with loss of appetite, nausea, vomiting, disorder of the bowels, failure of the strength, and progressive emaciation. These phenomena are particularly distinct when the lesion is confined to the stomach, in which case the patient, besides, often experiences a degree of tightness at the upper part of the abdomen, as if a bar or heavy weight were stretched across it. The pains are always augmented by pressure, and impart to the countenance a dull, haggard, and uneasy expression.

The species of softening now described is caused, it will be remembered, by a process of inflammation, either acute or chronic, and may occur in any part of the mucous system, not only of the alimentary tube, but of the rest of the body: it is characterized, moreover, by the circumstance of its being limited to the mucous textures, and by its never affecting the muscular and peritonæal tunics. Another variety, resulting from a very different cause, and which frequently produces extensive erosions and perforations, remains to be noticed. I need scarcely say that I allude to the softening occasioned by the *gastric juice*, or, more correctly speaking, the gastric acid. (Pl. VI, Fig. 8.)

The celebrated John Hunter, it is well known, communicated, at an early period of his professional career, his observations on the chemical solution of the mucous and other coats of the stomach, in a paper first published in the London Philosophical Transactions, and subsequently in his work on the Animal Economy. He describes this species of softening as a digestion of the tunics of the stomach, produced by the solvent powers of the gastric juice after death; and the reason which he assigns why this effect does not occur during life, is the constant resistance of the vital principle to its action. These observations were confirmed shortly afterwards by Spallanzani, of Italy, Adams, of London, and Allan Burns, of Glasgow, the latter of whom contributed some very valuable information on the subject, more particularly relating to the chemical solution of the stomach in individuals who died of protracted diseases; for it should be recollected that Hunter, having met with this lesion only in healthy animals, and in persons who had been suddenly deprived of life, by external violence, he advanced the opinion that a state of perfect in-

tegrity immediately prior to death was absolutely essential to its production. Very important additions have since been made by Baillie, Chaussier, Jäger, Gairdner, Carswell, and other writers, some of whom agree in the opinion of the great British anatomist, that the effect under consideration is the result of the action of the gastric acid; whilst others maintain that it is an idiopathic affection; and some, again, especially Cruveilhier and Louis, that it is caused by a high state of inflammatory irritation, which, occasioning a slow and protracted effusion of serosity, produces infiltration, distention, and ultimate disorganization of the delicate textures of the mucous membrane, leading finally to complete perforation of the intestinal tube.

It is not of little consequence that correct views should be entertained in regard to this subject, as it is one of much importance, not only in pathology, but also in juridical medicine. The French anatomists, it seems to me, have attributed entirely too much to inflammation; and, in their eagerness to deride the doctrine of John Hunter and his disciples, have lost sight of the physical and chemical properties of the gastric acid, which, it cannot be denied, is often fully competent to the production of extensive mollescence of the mucous membrane. When it is remembered, indeed, that softening, with erosion and perforation of the stomach and intestines, is frequently found after death in persons who, during life, do not evince the slightest gastro-enteric derangement, — that it occurs at any period of existence, alike almost in infancy, in manhood, and decrepid age, — and, finally that it is witnessed equally almost in those who are destroyed suddenly by external violence and those who die from chronic diseases, — we are fully warranted, I think, to conclude that, if the gastric acid is not the sole agent in the production of this lesion, it is certainly the most frequent and efficient cause of it.

But there are other reasons, of a still more cogent and unanswerable character, which justify us in attributing this effect to the agency of the gastric acid, and to nothing else. Mr. Hunter, in the paper already referred to, distinctly observes that the power of this fluid is not confined to the stomach alone, but that, after dissolving this organ in the usual place, which is at the great cul-de-sac, it would gradually extend to the spleen, intestines, and diaphragm, eroding them, and reaching as far sometimes even as the lungs. The truth of this statement derives additional force from the researches of Carswell, who, with a view of finally putting the question at rest, instituted a series of the most patient experiments, which he modified in almost every possible shape, and the results of which go directly to substantiate the doctrine of the solvent powers of the gastric acid. The queries which this distinguished philosopher wished more particularly to solve were the following: first, are the lesions noticed by various authors, under the appellations of softening, erosion, perforation, and digestion of the coats of the stomach, the same, or different morbid effects? secondly, are they produced during life or after death? if in the latter case, are they the result of the chemical action of the gastric acid? and, thirdly, what are the conditions and properties of the fluid to which they are to be ascribed?\*

In the prosecution of these researches, Carswell ascertained the interesting and important fact that these lesions can frequently be produced at pleasure, simply by removing the stomach of a healthy animal, clearing out its contents, and putting in contact with it a small quantity of gastric acid. In one instance, he placed the stomach of a recently killed rabbit, containing digested food, under a glass globe, and taking care to keep it moist with a little tepid water,

\* *Cyclopædia of Practical Medicine*, vol iv., p. 17.



he observed, in a short time, that the fundus of the organ became pale, then soft, thin, and transparent, and finally, at the end of four hours, there was a perfect dissolution of all the tunics, followed by an escape of chyme. When the softening was allowed to take place in the abdomen, and the gastric acid to come in contact with the surrounding organs, as the liver, diaphragm, spleen, or intestines, the same lesion was frequently observed in them as well as in the stomach, portions of these structures being more or less macerated and broken down. In a few of the experiments, the mollescence extended as far as the œsophagus, pleura, and lungs.

From the foregoing facts, Carswell justly concludes that softening, erosion, and perforation of the alimentary tube, whatever may be their extent, seat, or form, are caused by the solvent properties of the gastric acid, and not, as is asserted by the French pathologists, by inflammatory irritation; and, lastly, that whenever observed together, these lesions are invariably produced after death. Results similar to those of the British anatomists were obtained, as early as 1818, in a set of experiments on the same subject, by Dr. Camerer, a German physician. In one of these experiments, a drachm of gastric acid, taken from two children who died of mucous mollescence, was introduced into the stomach of a man, soon after death, and kept at a temperature of 170 of Fahrenheit for the space of twelve hours. At the expiration of this period, the mucous and muscular coats were found to be dissolved through to the peritonæum, wherever the fluid got in contact with them. The same liquid, conveyed into the stomach of a living rabbit, produced no sensible effect; but, after the animal was killed, its corroding properties soon manifested themselves. This observation, it will be perceived, strikingly illustrates the influence of the vital principle, so often adverted to by Hunter when speaking of the digestion of the coats of the stomach.

The *rapidity* with which softening, erosion, and perforation of the stomach may take place in the human subject, is well illustrated in a case which I had an opportunity of examining, about a year ago, along with Dr. Mount. It occurred in a female infant, seven weeks old, who was found dead one morning in her mother's arms, having expired apparently without a struggle. A month previously this child had had a severe cough, which continued for eight or ten days, when it gradually abated. It was also harassed, every evening for several weeks, with regular paroxysms of retching and vomiting, attended with occasional colicky pains, and latterly with diarrhœa.

On inspection, nine hours after death, numerous apoplectic effusions, from the size of a currant to that of a pea, were discovered in the pulmonic tissue, which, together with the universal engorgement, the injected condition of the bronchiæ, the distention of the right cavities of the heart, and the absence of any structural lesion, save a slight degree of hepatization of the inferior lobe of the left lung, made it sufficiently clear that the child had died of suffocation. In the great cul-de-sac of the stomach existed a rounded opening, with ragged edges, about the size of a dollar, through which had escaped a small quantity of mucus and gastric acid. The concave surface of the spleen was of a pale color and macerated appearance: the contiguous portion of the omentum was slightly softened, and in two places perforated. The mucous membrane around the opening in the stomach was of the natural complexion and consistence, nor was there any where the slightest sign of disease.

The question may be asked here, — why is it that these effects, so conspicuous in some cases, do not occur, to a greater or less extent, in all? Carswell, who, as was before hinted, has endeavored to solve this problem by an appeal

to direct experiment, thinks that the difference depends upon some altered condition of the gastric juice ; or, in other words, that in proportion precisely to the *acidity* of this fluid will be its solvent and eroding properties. The accuracy of this conclusion is sufficiently confirmed by the fact, that if the liquid in question be neutralized by a small quantity of magnesia, no softening whatever will happen in the stomach of an animal that has been just killed. The sour smell of the gastric juice is often remarkable, and the effect which it has, under certain circumstances, of setting the teeth on edge, as it is vulgarly termed, is familiar to every one. The presence of free muriatic acid in this liquid has been fully established by the researches of numerous chemists, while its macerating and corroding properties were long ago pointed out by Spallanzani, Stevens, and other physiologists.

With respect to the *situation* of this species of softening, it is a matter of some moment to know that it always takes place at the great cul-de-sac of the stomach, in consequence of its depending position favoring the accumulation of the gastric acid, as well, perhaps, as from this fluid being secreted here in larger quantity than elsewhere. The only exception to this rule arises where there is an enlargement of the spleen, or some tumor pressing this part of the organ up, and thereby rendering the pyloric extremity the lowest point. When there is softening of the intestines, with erosion and perforation, it invariably occurs in the loops lodged in the epigastric region, in close proximity with the stomach. Under no circumstance, at least so far as my observation extends, has this variety of mollescence been noticed in the more dependent portions of the digestive tube, or in the urinary bladder.

The *extent* of the lesion is very variable, being either limited to a small portion of the stomach and bowels, or occupying the whole surface of the former, with a considerable portion of the latter. Occasionally, it is observed entirely in the intestines, which can only be explained on the assumption that the gastric acid, having left the stomach, has accumulated in inordinate quantity in the latter organs. When the softening is accompanied with perforation, it may extend, as was before stated, to the œsophagus, liver, spleen, diaphragm, and even the lungs, all of which viscera may therefore be affected in the same individual, and exhibit various degrees of dissolution.

Not unworthy of brief notice is the *form* which the softening presents in different parts of the digestive tube. When confined to the fundus of the stomach, the lesion generally occurs in irregular patches, varying much in size, the edges of which are formed by the mucous membrane, and their surface by the subjacent cellular texture. Very generally the margins of the erosions are thin, soft, ragged, and transparent. When the softening penetrates beyond the muscular tunic, the margins are bevelled outwards, and terminate in delicate and irregular processes, which exhibit a tattered, shred-like appearance on being immersed in water. The same form precisely is perceived when the lesion affects the peritonæum. This patch-like softening usually takes place whenever the mucous membrane happens to be stretched ; but should it be thrown into folds, it will assume a different shape, and occur in stripes and bands of a light bluish tinge, forming thus a striking contrast with the sound surface, which is either of the natural color, rosaceous, or of a light vermilion. These stripes and bands, it should be stated, always have the situation and direction of the mucous wrinkles, the intervals between them being very slightly or perhaps not at all changed in their consistence, — a circumstance which may be easily recognized by floating the parts in clear water. Occasionally, though very rarely, the softened membrane is of a light orange hue ; and the vessels traversing it, if there be any, which, however, is not always the

case, are filled with black blood, which, as I have repeatedly witnessed, is unsusceptible of any change upon its exposure to the atmosphere. Redness of the affected texture is never observed; its existence being incompatible with the chemical action of the gastric acid.

The *degree* of softening presents several important varieties. At first the membrane has very much the same consistence as in mollescence from inflammation; but, as the process advances, it is gradually converted in a greyish, pulpy substance, which can be easily removed with a sponge or by a stream of water, leaving the submucous cellular tissue of a dark silvery color. Instances occur, especially in young children, in which the membrane is reduced to the consistence of a hot solution of starch, arrow-root, or isinglass.

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## SECTION IV.

### OF THE DISEASES OF THE STOMACH.

That *ulceration* of the stomach should occasionally occur, is not at all surprising when we take into consideration the great extent of its surface, the delicacy of its organization, the variety of its functions, its important sympathetic connections with other organs, and the heterogeneous nature of its contents. Yet, that this event is much less frequent than was at one time supposed, is abundantly proved by the general experience of the profession. Extensively as I have been engaged in pathological researches, it may be safely asserted that I have never met with this lesion in more than three or four instances. Nor have I been wanting in proper precautions with regard to the cleansing and minute inspection of the mucous coat. True it is, my observations were not conducted formerly with so much patience and accuracy as they have been for the last eight years; still, every thing confirms me in the belief that ulceration of the stomach is decidedly amongst the rarest diseases to which this important organ is subject.

Ulcers of the mucous membrane of the stomach are seldom either large or numerous. Most generally, indeed, there is only a single one, which is then of considerable size. Occasionally, however, they are extremely numerous, as in the case of a man of thirty-three, in whom I counted upwards of sixty. When they are seated in the glands of Brunner, as was the case in the instance just referred to, they are almost always much smaller than when they affect the intervening texture, their magnitude rarely exceeding that of a split pea. In the other variety, they often attain the size of a Spanish dollar, especially when solitary; and instances are not wanting in which they were much larger.

Not less variable are the shape and depth of these erosions. Their most common appearance is that of depressed breaches of continuity of the mucous corion, of a roundish form, with edges slightly elevated above the level of the internal surface. Not unfrequently, however, they are remarkably irregular, their margins hard and thick, fissured, or even granulated. Appearances like these are especially observable in old chronic cases, but are very rare in such as are recent. In a number of instances I have seen the edges partially undermined, so that, upon being floated in water, they presented that ragged, shreddy aspect, which is so often witnessed in erosions of the small intestines.

The bottom of the ulcer may be formed by the cellular tissue, or it may



erode through this and the muscular layer, so as to lie upon the peritonæal covering. In the latter case, it is not uncommon for perforations to take place, and for the contents of the stomach to escape into the abdominal cavity or into some one of the neighboring organs. Most generally a communication is established with the arch of the colon, the walls of which, as the erosive process extends, are firmly cemented by means of lymph with those of the stomach. In this way, the individual may sometimes live for years, with very little inconvenience. Oftentimes the bottom of the sore is hard and thickened, from the hypertrophous condition of the subjacent textures, or, as more rarely happens, from a deposition of small patches of lymph. Its color is usually pale; but may be of a light rose tint, brownish, or crimson. Under no circumstances, scarcely, is the base of the sore of so deep a hue as the edges.

It has been already mentioned that ulcers of this organ are occasionally followed by *perforation*. Much light has recently been thrown upon this subject by Mr. Edward Crisp, of Walworth, England. In a very interesting paper, inserted in the London Lancet for August, 1843, he has given an analysis of fifty-one cases, of which I subjoin the following abstract.

Of the whole number of patients, thirty-nine were females and twelve males. Of the former, twenty-one were between fifteen and twenty years of age; ten between twenty and twenty-five; five between twenty-five and thirty; one was forty, one fifty, and one sixty. Of the males, only one was under twenty years of age. The aperture in the majority of the female patients was situated in the smaller curvature of the organ, more frequently between the pyloric and cardiac orifices, but in many instances near the latter. In one case only was the perforation close to the pylorus. In nine examples, two ulcers were present, opposite to each other; so that when the stomach was in a state of collapse, the diseased parts were in contact. The greater number suffered from dyspeptic symptoms prior to the attack; the most frequent of which were occasional pain in the epigastric and right hypochondriac regions, pyrosis, and flatulence. Vomiting was not a constant attendant, although it was present in many instances. The menses were irregular in thirteen, and not a few were affected with chlorosis. Most, if not all, were unmarried.

In the male patients the perforation was situated, in nine, close to the pylorus, and in three, midway between the two orifices. Mr. Crisp thinks that simple ulceration in the cardiac extremity of the stomach in men is very rare.

The period which intervened between the perforation and the death of the patient varied from twelve to thirty hours. In one instance life was prolonged for nearly three days. The lesion usually occurred a short time after a meal, and the chief characteristic symptoms were violent and sudden pain in the region of the stomach, spasm of the abdominal muscles, and extreme anxiety of countenance, with a sharp, quick, and thready pulse. The intellect was generally unaffected.

One of the most interesting and instructive circumstances connected with ulceration of the mucous membrane of the stomach is, that the sores thus induced occasionally undergo a process of reparation, similar to the cicatrization of ulcers in other parts of the body. (Pl. VI, Fig. 9.) The possibility of such an occurrence has been questioned by very able pathologists, — more, perhaps, however, from their having been governed by speculative views than by actual observation. The facts published by the French, English, and German writers leave, indeed, no longer any doubt upon the subject. Reil, Meckel, Troillet, Andral, Graves, and Cruveilhier have each given well-marked examples of it. The latter of these distinguished anatomists has delineated several cases in which ulcers of the stomach, of considerable size,

were completely healed, with the contiguous mucous corion in a contracted and puckered state. The cicatrice was always of a bluish color, and of a dense, fibrous texture, very different from the characters of the natural tissue.\* In 1832, I examined the body of a young lady, about thirty-three years of age, who had been laboring for a long time under all the symptoms of chronic gastritis, attended with extreme emaciation. In the posterior wall of the stomach, nearly midway between the great tuberosity and the pyloric extremity, was an old ulcer, about the size of a five franc piece, the edges of which were puckered, thickened, and completely cicatrized. All the tunics were destroyed; and the contents of the organ were prevented from escaping by the manner in which it was glued to the anterior surface of the pancreas, which thus formed the bottom of the erosion. The rest of the stomach was perfectly sound, excepting that its coats were much thinner than usual, and remarkably blanched. A case, in many respects similar, has been described by Professor Recamier, of Paris.

Another equally conclusive instance of this sort of reparation is furnished in the case of the celebrated Beclard, author of the well-known "Elements of General Anatomy." When this individual died, a completely cicatrized ulcer, about the magnitude of a quarter of a dollar, was discovered in the small curvature of the stomach, a few lines from the cardiac extremity. Its surface, considerably depressed, was traversed by a central band of white fibrous matter, on each side of which was a shallow cavity, formed by the peritonæal tunic. The rest of the organ was perfectly healthy.

It thus clearly appears, from the foregoing observations, that ulcers of the mucous membrane of the stomach, even when of considerable magnitude, are susceptible of healing. Such a reparation, however, is always difficult, from the surface of the sore being constantly exposed to the irritating contents of the organ, by which the salutary efforts of nature must be very frequently baffled. The first step in the process seems to be an effusion of fibrin, by which the loose margin of the ulcer is tied to the subjacent parts. By degrees, a similar substance is deposited upon the bottom of the sore, which in time is transformed into a granulating surface, bathed with a thin muco-purulent fluid. Thus, day after day, the process proceeds until the cicatrization is completed, the ulcer in the mean time diminishing in size, and acquiring a bluish, puckered appearance. The new product, it should be observed, although it occasionally attains the consistence and thickness of the natural membrane, is yet essentially different, being less smooth, less vascular, more easily destroyed by subsequent attacks of disease, destitute of follicles, and incapable, therefore, of secreting real mucus.

The portions of the stomach most liable to ulceration are the cul-de-sac and great curvature, from their being more constantly in contact, perhaps, with our food and drink. No part of the organ, however, is exempt from it.

The signs which denote the existence of gastric ulceration during life are not always well-marked. Occasionally, indeed, the disease is entirely latent, exhibiting no phenomena whatever by which it can be recognized. Most commonly, however, the patient complains of the ordinary symptoms of chronic gastritis, such as nausea, with occasional vomiting, difficult digestion, colicky uneasiness, and gnawing pain in the epigastric region. With these signs are usually conjoined, when the ulcers are large, deep and numerous, great emaciation, considerable fever, especially in the evening, constriction of the features, and coldness of the extremities. In many cases there are repeated

\* Anatomie Pathologique de l'Homme, Livraison x., p. 7, plates 5 and 6.

attacks of vomiting of blood ; and a symptom upon which Cruveilhier lays a good deal of stress, is the existence of a *dorsal stitch*, or a severe and steady pain in the neighborhood of the lower vertebræ of the back. Occasionally, large-sized vessels are exposed by the ulceration ; and, in this way, exhausting and fatal hemorrhage may take place.

The period which elapses from the commencement of the inflammation until the supervention of ulceration, must vary, of course, in different cases and under different circumstances, so as to render it impossible to lay down any definite rules. In general, however, it will not be going too far to say that erosions do not begin to form under several weeks after the establishment of the disease which gives rise to them. Nay, very often there is reason to suppose that the antecedent inflammation is not only remarkably tardy in its progress, but of an extremely low grade.

*Hypertrophy* of the stomach is by no means so uncommon as was formerly supposed by pathologists. Excepting the peritonæal, it may invade all the tunics simultaneously, or be confined to a single one, which is, in fact, most generally the case. Sometimes the enlargement mainly attacks the mucous follicles, giving the internal surface of the organ a rough, *mammillated* fulness, the widened orifices of the glands identifying the seat of the affection. This state of the mucous membrane of the stomach is of very frequent occurrence in chronic inflammation : I have several times met with it as a complication of diabetes, and Louis has often observed it in pulmonary phthisis. The mammillated prominences, which are generally of a rounded, conical shape, and from the size of a currant to that of a filbert, strongly resemble the granulations of an old ulcer, and are occasionally separated by deep narrow grooves, running in different directions. Their length is subject to much variety. In some instances, it does not exceed half a line ; in others, it is more than a third of an inch. In my own dissections, I have invariably found this mammillated appearance of the mucous coat most conspicuous in the inferior half of the organ.

The mucous membrane in this affection is usually of a pale reddish tint, like the surface of an indolent ulcer ; occasionally, it is almost white, greyish, or drab-colored. In most cases, it is abnormally firm and thick, allowing itself to be raised in large shreds. The villousities, also, are sometimes much augmented in size, and truly hypertrophous. There are no diagnostic signs of this disease. In some of Louis's patients, there was merely an impairment of the appetite ; in others, epigastric tenderness, with nausea and vomiting.

To the same class of lesions are to be referred those singular looking *warty excrescences* which are sometimes to be observed upon the mucous membrane of the stomach. Their shape is generally rounded ; their size inconsiderable ; and, in most cases, they adhere by a narrow footstalk, of considerable length. Much diversity prevails in regard to their internal structure, which is sometimes fibrous, sometimes fungous, and sometimes vascular and erectile. Their color varies in different cases. For the most part they are greyish, but occasionally reddish, brownish, or blackish.

Hypertrophy of the *fibro-cellular tissue* is characterized by considerable thickening and induration, with or without change of structure of the other tunics : the areolar texture is destroyed, and replaced by a dense albuminous substance, which may be so firm as to prevent the stomach from collapsing when opened. There is some variety in the color of the affected part. Occasionally it bears some resemblance to a mixture of bees-wax and tallow ; more commonly, however, it presents the appearance of a piece of well-boiled tripe,



with some sections of it more transparent than others. The hypertrophy is not always limited to the submucous cellular tissue. Cases are frequently met with in which it involves the subserous substance, and even that between the muscular fibres, rendering the latter pale and thin, or else, as we shall presently see, remarkably large and distinct.

Hypertrophy of the *muscular coat* varies in different cases. It may be very slight, — perhaps, hardly perceptible, — or it may amount to an enormous degree, both as regards thickness and the extent of surface which it occupies. Rarely does it pervade the whole organ; on the contrary, it usually occurs in considerable sized patches, either alone, or in union with hypertrophy of the cellular tissue. In this affection, the muscular fibres are unusually large and distinct, harder, more dense and florid than in the natural state, forming frequently thick, membranous intersections, and producing an appearance not unlike that of the inner surface of the heart. The individual fasciculi are sometimes from three to five, or even six lines in diameter. In most instances of this species of hypertrophy, the patient labors under cancer, or some disease or other which forces the organ habitually to reject its contents. It is also noticed sometimes in great eaters.

Less frequent than the affections here noticed is the extreme attenuation of the coats of the stomach, constituting what is denominated *atrophy*. In making necroscopic examinations, cases sometimes present themselves in which the walls of the stomach are remarkably thin, pale, and emaciated, being reduced to a soft, flabby substance. Under such circumstances, the peritoneal covering seems as if it had been bleached: the muscular fibres are scattered, and almost colorless; and the mucous membrane is diminished in thickness, pallid, deprived of its villousities, and scarcely capable of being separated from the subjacent textures. A degree of atrophy like this, however, is extremely rare, and has occurred to me only once. Partial attenuation is more commonly observed at the great cul-de-sac than in any other portion of the stomach. In several instances, I have also seen it immediately below the cardiac extremity. How far atrophy of this organ has any connexion with chronic irritation, it is difficult to say; but that there is some dependency of this sort, most pathologists, I believe, are ready to admit.

The stomach is sometimes much reduced in size from prolonged fasting, cancerous affections, or protracted pressure; and cases occasionally happen, in which, from excessive gluttony, or the effects of disease, it is enormously enlarged. Some very interesting examples of this latter lesion are to be found in different works on morbid anatomy; but the most instructive instance with which I am acquainted was recently published by Dr. Yvan,\* who exhibited the specimen to the Royal Academy of Medicine of Paris. The subject of it was a soldier, who for some years had had a large scrotal hernia, attended, during the last month of his life, with the most intractable vomiting, although there was no strangulation. On examination after death, the stomach, situated parallel to the axis of the body, was found to be of an enormous volume, and to be divided by a circular depression into two portions, the one lying in the abdomen, the other in the hernial sac. The length of the great curvature was three feet, the circumference at the widest part twenty inches, and the capacity nearly a gallon and a half. The muscular fibres, as well longitudinal as circular, although considerably attenuated, were yet quite distinct throughout the greater part of the organ.

A part of the stomach is occasionally formed into a *pouch*. Of this I have

\* Archives Générales, January, 1830.

never seen an example ; but Dr. Baillie mentions one which came under his own observation, and which had been produced by the swallowing and subsequent retention of five half-pennies. The walls of the pouch were considerably attenuated, but not inflamed nor ulcerated.

Pieces of *cartilage* are sometimes, though rarely, noticed in the stomach, where they grow either between the mucous and muscular tunics, or between the latter and the peritonæal. Occasionally they appear in the form of small, irregular tumors, projecting upon the inner surface of the reservoir. They are most common towards the pyloric extremity, and are frequently connected with cancerous formations. De Haen has described a bony deposit in the stomach, of what extent he does not inform us.\*

Various kinds of *tumors* have been repeatedly observed in this organ. Ruysch saw in the stomach of a man a morbid growth which contained hair and several large grinders. *Polypes* are very rare. The only well-authenticated case of which I have any knowledge, is to found in Dr. Monro's Morbid Anatomy of the Gullet, Stomach, and Intestines. The patient was a lady, forty-five years old, who had complained of indigestion and pain in the epigastric region. A tumor, of an oval shape, and about the size of an orange, adhered by a short neck to the villous membrane of the stomach ; its surface was quite smooth, and the internal texture so firm, solid, and tough as to offer considerable resistance to the knife. A section of it exhibited a uniform appearance.

Authors make mention of *steatomatous tumors* as of occasional occurrence within the stomach. They are usually encysted, and contain a semi-concrete substance, resembling suet, tallow, or soft wax. This morbid product is extremely rare, and has never been well described. Perhaps the best account is that by Vic D'Azyr ; but even this is so meagre as to afford nothing satisfactory upon the subject.

The stomach is more liable to *carcinoma* than any other portion of the alimentary canal. The disease is almost peculiar to old age ; and the parts most frequently attacked are, first, the pylorus ; secondly, the cardiac extremity ; and thirdly, the body of the organ. The morbid deposit may be limited to particular situations, or it may affect nearly the whole stomach, the coats of which it transforms into a dense, gristly substance, intersected by whitish membranous bands, with hardly a vestige of the original structure. Of this variety of cancer died Napoleon Buonaparte. His body was inspected on the 6th of May, 1821, at Longwood, St. Helena. The internal surface of the stomach, says the report of the examiners, through nearly all its whole length, was a mass of cancerous disease, intermixed with portions of scirrhus ; the cardiac extremity, for a small space around the œsophagus, being the only part that was healthy. The pyloric extremity adhered extensively to the concave surface of the liver, and about one inch from its orifice presented an ulcer, which penetrated the coats of the organ, and was sufficiently large to allow the passage of the little finger.

Most generally the disease appears in the form of distinct tumors, or nodules, varying in volume from a small nut to a fœtal head. With a surface that is often very rough, irregularly mammillated, or marked off into numerous lobules, they are found to exhibit a great variety of texture, some parts being fibrous, some fibro-cartilaginous, some osseous, some mammary or lardaceous, some fungoid, some medullary, some gelatiniform, and some hæmatoid. It is seldom, however, that these substances are thus combined. Most generally,

\* Rat. Medend, t. iv., cap. i.

indeed, not more than two or three co-exist, and in many cases they occur separately. In their primordial conditions, the tumors are usually entirely fibro-cartilaginous; and afterwards, as their development proceeds, other textures are either superadded, or such as previously existed are modified and transformed.

The mucous membrane, in carcinomatous disease of the stomach, is variously affected. In the generality of cases it is very much thickened, sometimes as much as a fourth of an inch, indurated, elevated into irregular masses, and of a light greyish color. In others, again, it is of a dull yellowish, greenish, or light mahogany tinge, soft, pulpy, or almost brain-like, vascular, ulcerated, or partly destroyed. Several of these morbid alterations are generally met with in the same specimen. The submucous tissue is also usually more or less changed: the most common appearance is a dull yellow, lardaceous degeneration. The muscular fibres are unnaturally distinct; and the peritonæal tunic, although it does not always participate in the disease, is often much thickened, and almost of a gristly consistence. The stomach is commonly diminished in its capacity, and contains a very offensive gas, with a small quantity of dark-coloured fluid, like coffee-grounds. The neighboring lymphatic ganglions, even at a tolerably early period, are more or less enlarged, red, and softened; as the deposit progresses those nearest the tumor degenerate into carcinomatous disease. The submucous cellular tissue is sometimes the seat of hemorrhagic effusions, and blood is also occasionally poured into the cavity of the organ, either in the form of an exhalation, or in consequence of the rupture, or partial destruction, of one or more small vessels.

When the disease is seated at the pyloric extremity, this part is more or less changed in its character. The heteroclitic matter may present itself in the form of a distinct layer, of variable thickness and consistence; or, as more generally happens, it may occur as a solitary tumor, of a pale bluish color, rounded or ovoidal in its shape, knobby, and as big as an orange, a goose-egg, or a common-sized fist. In its structure it may be fibro-cartilaginous, or partly fibrous, and partly bony, cerebriform, or colloid, according as there is a predominance of one or the other of these substances. The pylorus itself may be

Fig. 135.

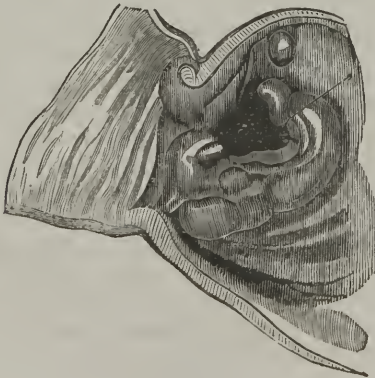
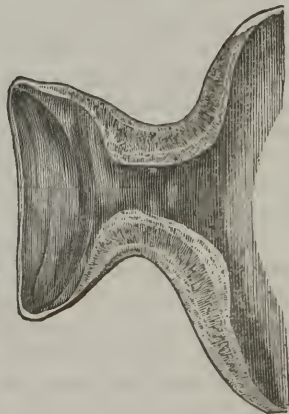


Fig. 136.



natural or only slightly changed; but in a great majority of cases it is transformed into a thick, hard, gristly ring, the orifice of which may be so much



contracted as scarcely to admit the end of the little finger. In a preparation in my possession the opening is reduced to the size of a goose-quill. The coats, both of the stomach and duodenum for some distance above and below the tumor, are thickened, altered in color, and augmented in consistence. The liver and pancreas are often diseased, from their proximity to the seat of the morbid growth; and the pyloric extremity occasionally adheres extensively to the surrounding parts.

Scirrhus of the pylorus is represented by the preceding wood-cuts. In Fig. 135 the heteroclitic matter presents itself in the form of a tumor, rough, knobby, ulcerated at the centre, and projecting slightly into the duodenum; in Fig. 136, it is infiltrated into the submucous cellular tissue, which, together with the mucous membrane, is greatly hypertrophied. The pyloric orifice is very much diminished in size.

The *symptoms* of carcinomatous disease of the stomach are often extremely obscure, and, what is singular, are never so urgent when the lesion is seated near the cardiac extremity as when it involves the pylorus. In most cases, the signs are those of chronic irritation; that is, the patient is afflicted with indigestion, lancinating pain, constant acidity and flatulence, and occasional vomiting. There is considerable emaciation, with gradual wasting of the muscular powers; the eye is sunk, the complexion sallow, and, towards the last, the matter ejected from the stomach has a very offensive smell, and is of a dark color, like coffee-grounds. These symptoms, it is obvious, are not diagnostic; nor should they ever be so regarded, unless the scirrhus tumor be at the same time perceptible by the hand placed upon the abdomen.

The stomach, like other hollow viscera, is liable to *laceration*. The causes are, external violence, as a blow or kick, straining at stool, and efforts at vomiting. The accident may happen when the organ is perfectly healthy, or it may be preceded by ulceration, softening, gangrene, or cancerous degeneration. In the inferior animals the laceration is sometimes produced by over distention from gas; but no such case that I am aware of is recorded as having occurred in the human subject. When the viscus is diseased, the rupture may result from the most trifling exertion. Bouillaud\* relates the case of a person whose stomach burst while he was straining at stool. The perforation was caused chiefly by the pressure of the abdominal muscles, and was seated at one of the extremities of an extensive ulcer, the bottom of which was formed by the pancreas. Andral† mentions an instance where the rupture was produced by vomiting, from the use of two grains of tartar emetic. The patient expired in a few hours after the accident, and an examination of the body revealed the existence of a perforation, with traces of an old ulcer of the mucous membrane, and great disorganization of the subjacent tissues. In the horse, vomiting artificially induced, is said to be peculiarly liable to be followed by rupture of this organ, in consequence of the powerful pressure exerted upon it by the abdominal muscles. Similar effects are sometimes witnessed in the human subject from spontaneous vomiting, as in the cases recorded by Chevalier and Weekes. In the latter, the opening was situated on the anterior surface of the organ, near the œsophageal orifice; it was about four inches in length, ragged, and extended a little farther through the serous tunic than the muscular or mucous. A long rent, merely affecting the peritonæal covering, existed on the posterior surface of the organ, and several smaller ones at the great curvature.‡

In the case reported by Chevalier§ the injury was confined to the mucous

\* Archives de Médecine, t. i., p. 534.

† Pathological Anatomy, vol. ii., p. 77.

‡ Medico-Chir. Trans. of London, vol. 14, p. 447.

§ Ibid., vol. v., p. 93.

membrane, which was torn in various places both in the stomach and the duodenum. The fissures were much larger in the latter than in the former; and near the pylorus they almost encircled the gut, which presented, besides, two other extensive ruptures about its middle. The rest of the alimentary canal was perfectly sound.

Rupture of the stomach, attended with perforation and an escape of the contents of the organ, is always fatal, death occurring from a few hours to two or three days after the accident. When the rupture is partial, that is, seated in the mucous or serous membrane, the breach may be repaired in the ordinary manner; or, as in the latter case, the organ may contract adhesions with the surrounding parts, and thus farther mischief be prevented.

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## SECTION V.

### OF THE DISEASES OF THE DUODENUM.

The organic lesions of the duodenum are in many respects so peculiar, that they deserve to be considered separately. Nor are they uninteresting on another account. From the close proximity of the organ to the stomach, liver, gall-bladder, and small intestine, with all of which it may be said to be directly continuous through the intervention of its mucous lining, disease can hardly ever exist in one of these structures without implicating the other. No where, indeed, is there a more striking instance of the operation of what Mr. John Hunter and his followers have denominated contiguous sympathy, than in the viscera now under consideration. What takes place in the conjunctiva of the eye, in severe inflammation of the Schneiderian membrane of the nose, may be supposed to occur precisely in the inner coat of the gall-bladder, common and hepatic ducts, in acute duodenitis. Here disease is directly propagated from one part to another, because of the similarity of structure of the lining membrane; nor is it uncommon to find that the organ which is secondarily involved, is obliged to bear the onus of the irritation. In this manner, there is reason to believe, is often produced congestion of the portal system; the disease, in the first instance, being, perhaps, merely an acute inflammation of the mucous membrane of the duodenum or stomach, which, by propagation, involves the corresponding tissues of the liver and gall-bladder, and thus causes that profound obstruction so much insisted upon by some pathologists.

This mode of accounting for the occurrence of certain forms of portal congestion will appear the more plausible if we reflect upon the immense size of the liver and upon the fact that the excretory tube of each of its component granules is lined by a mucous membrane. If this be done we shall be forced to regard the organ not simply as a parenchymatous structure, but as a mass of mucous follicles, subject to the same disorders as the duodenum, which adjoins it, and which sends into its interior one of its own tissues. Thus it will be perceived how disease may be propagated from one of these viscera to the other; how an irritation, seated in the mucous membrane of the duodenum, may affect that of the liver; how the functions of the latter may be impaired by the former; and, conversely, how an inflammation of the liver may be transferred to the duodenum, the stomach, and, perhaps, also to the mesenteric portion of the small bowel, and commit the most serious and extensive mischief.

“The leading peculiarity of disease of the duodenum, as far as we are at

present acquainted with it," says Dr. Abercrombie, "seems to be, that the food is taken with relish, and the first stage of digestion is not impeded; but that pain begins about the time when the food is passing out of the stomach, or from two to four hours after a meal. The pain then continues, often with very great severity, sometimes for several hours, and generally extends obliquely backwards, in the direction of the right kidney. In some cases, it gradually subsides after several hours, and, in others, is relieved by vomiting."\* This account has evidently reference to chronic, not to acute disease. In acute duodenitis, whether simple or complicated, the most prominent symptoms are, pain in the right hypochondriac region, spasmodic, deep-seated, and augmented by pressure and full inspiration; more or less nausea and vomiting; and a yellow state of the skin and eyes. Frequently the pain is of a dull, gnawing character; and in no case can the patient swallow solid food without the utmost aggravation of all his sufferings. Duodenitis is almost always present in yellow fever; and jaundice, as is well known, frequently depends upon the same affection, either in its acute or chronic form.

Ulcers of the duodenum, whether originating in its mucous membrane, or in its follicular structure, are extremely rare, and run pretty much the same course as those of the stomach. In ninety-two cases of ulcerated bowel, observed by Andral, only one occurred in the duodenum; and if this be taken as an average estimate, it must be evident that this portion of the alimentary tube is peculiarly exempt from such lesions. That they are infrequent, my own experience abundantly confirms. There is seldom more than one erosion; nor is it very common to observe them below the insertion of the chole-doch duct. It is not improbable that the ulcers may heal; nevertheless, owing to the irritating nature of the bile which lies so constantly in contact with this portion of the small bowel, they manifest a remarkable tendency to extend their ravages from the mucous to the other tunics.

The peculiar characters of ulceration of the duodenum are well illustrated by a case related by my friend, Dr. W. F. Irwin, of Pittsburgh.† The patient was sick for several years, and during the last six months of his life was liable to daily paroxysms of pain and vomiting. His bowels were habitually constipated, and could never be moved without the agency of purgative medicines. What was remarkable, and what may be almost regarded as pathognomonic of duodenal disease, was, that the digestive process usually went on well for two, three, or four hours after taking food. He was then attacked with violent pain and vomiting, which regularly continued until the stomach was thoroughly freed of its contents. In this way he lingered on until he finally expired, in a state of great emaciation. On inspection, the duodenum was found to be in a hard, firm, cancerous condition, much enlarged, and the whole internal surface covered with ragged ulcerations. Numerous tubercles were also observed. They varied from the size of a hazelnut to that of a hickorynut, and the largest of them contained a white, friable matter, resembling dried cream. The quantity of pus found about the diseased part of the bowel was upwards of a gill. The stomach, though enormously enlarged, was apparently quite healthy, as were also the small and large bowels, the liver, and spleen. The pancreas, reduced to one half its natural bulk, was in a state of scirrhus induration.

When perforations take place, the contents of the tube may, as in the case of the stomach, escape either into the peritonæal cavity, or into some

\* Pathological and Practical Researches, p. 119.

† Philadelphia Journal of the Medical and Physical Sciences, vol. viii., p. 406.



of the surrounding organs. In a preparation in the college museum, the duodenum communicates with the fundus of the gall-bladder; and in another, taken from a gentleman sixty-eight years old, with a large pouch formed by the convex surface of the liver, and the contiguous portion of the diaphragm. Without entering into all the particulars of this remarkable and, so far as I know, unique case of disease, it may be briefly stated that the outlet of this extraordinary sac was a circular opening, about the size of a half-guinea, with thick, rounded, and well-defined margins, which was situated one inch below the pylorus, on the upper wall of the duodenum, which, as well as the arch of the colon, adhered extensively to the anterior border of the liver. Leading from this aperture, in a direction obliquely upwards and outwards, was a narrow tortuous sinus, which, after a course of about one inch and a half, communicated by means of a small, elliptical slit, with the pouch previously adverted to. This artificial reservoir, formed in the manner before mentioned, was flat, circular, a little more than six inches in diameter, and capable of holding about ten ounces of fluid, although perfectly empty at the time of the examination. It was lined throughout, however, by a thick, dense layer of lymph, of a yellow-greenish color, from the inter-mixture, probably, of fecal matter, which must have passed into it at different times from the perforated duodenum. On cutting into this substance, the hepatic texture was found to be perfectly sound, excepting for about the fifth of an inch in depth, where it was somewhat softened, and of a dark bluish tint. The diaphragm, dark-colored and deeply injected, adhered firmly all around the anterior surface of the liver, the attachment extending about an inch beyond the longitudinal fissure, leaving the remainder of the left lobe perfectly free and healthy. The liver was of the natural size, and, with the exception specified, quite sound. The gall-bladder and other abdominal viscera presented nothing worthy of special notice. The right lung was in a state of purulent infiltration; the cartilaginous rings of the trachea and bronchiæ ossified; the heart softened; the parotid glands enlarged and suppurated.

The subject of this remarkable lesion had been liable, throughout life, to attacks of rheumatism, but had otherwise enjoyed good health. A few years before his death, he gradually lost flesh, his complexion assumed a dark sallow aspect, the skin became dry and bloodless, the bowels were torpid, and the pulse was weak and intermittent. In the month of April, 1837, he was suddenly seized with excruciating pain in the epigastric region, attended with reduction of temperature and great prostration of strength. Large doses of stimulant and narcotic medicines, with counter-irritants, afforded some relief, and produced a certain degree of reaction, with a paroxysm of emesis. His bowels were opened with cathartics, and he was bled at the arm, but the pulse sunk under the operation. Much debility ensued, with occasional fever, cough, and dyspnœa. After a few days, the parotid glands became swollen and indurated. Finally, hiccup supervened, and continued to recur until he expired, which happened on the 13th of May, nineteen days after the attack of epigastric pain. For an account of the symptoms of this case, and for the opportunity of making the post-mortem examination, I am indebted to Professor Drake, whose zeal in the cause of pathological science is well known to the profession.

Cases are occasionally observed in which the duodenum is *ruptured*, apparently without any previous lesion. Of this a highly interesting instance has been detailed by Professor Drake, in his *Medical and Physical Journal* for April, 1839. The patient was a cordwainer, thirty-eight years of age. The

symptoms were those, in the first place, of violent colic, and afterwards of acute peritonitis, — death occurring in sixty hours from the commencement of the attack. On inspection, the duodenum, at the pylorus, was found to be ruptured more than half way round, the fissure exhibiting the appearance of a clean cut. Through this the contents of the tube, as well as of the stomach, had escaped into the peritonæal sac, and excited fatal inflammation. No ulceration existed any where, nor had any part suffered gangrene; in short, there was not the slightest organic change of any kind that could account for the laceration.

Broussais\* mentions a singular case of a man, sixty-three years of age, in whom an ulcer was discovered in the upper portion of the duodenum, which had formed a communication with the hepatic artery. The intestinal canal was found full of blood. In a case described by Dr. Streeter,† of England, the duodenum opened externally, between the seventh and eighth ribs, by means of a canal two inches and a half in length, through which articles of food and drink were frequently discharged. The tube was greatly contracted beyond the seat of the communication, and the patient lived about a month after it took place.

*Curcinomatous* and other tumors are occasionally found in the duodenum; but I suspect they are extremely infrequent; and, thus far, no instance has fallen under my own observation. When seated in the neighborhood of the outlet of the choledoch ducts, such tumors, by preventing the flow of bile, may cause distention of the gall-bladder and congestion of the biliary passages, with all the contingent phenomena of jaundice. In the same manner may arise obstruction and enlargement of the pancreas.

The duodenum is sometimes enormously *enlarged*. Cases have been recorded in which it equalled in volume the stomach. Its tunics are also liable, though much more infrequently than those of the rest of the alimentary tube, to thickening and attenuation.

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## SECTION VI.

### OF THE DISEASES OF THE SMALL BOWELS.

The diseases and injuries of the small intestines may be arranged under the following heads: — 1, ulceration; 2, disease of the glands of Peyer, as productive, or concomitant of, typhoid fever; 3, hypertrophy; 4, atrophy; 5, tubercle; 6, the milt-like tumor; 7, melanosis; 8, concretions; 9, fatty discharges; 10, laceration; 11, internal strangulation; 12, hernia; 13, abnormal sacs; 14, wounds; 15, artificial anus.

1. *Ulceration*.—Among the most common organic affections of the small intestines, properly so called, are *ulcerations*. Comparatively infrequent in the upper portion of the tube, they always increase as we approach the cæcum; and, in the great majority of cases, it is not unusual to find them entirely confined to the inferior half of the ileum. In their shape they may be circular, elliptical, or linear, the frequency of their occurrence being in the order here enumerated. Their dimensions vary from a line to several inches; their margins, which are

\* Sur la Duodénite Cironique.

† Mitland Medical and Surgical Reporter. November, 1829.

ordinarily elevated and ragged, are greyish, pink, or rose-colored, more rarely brownish or blackish; their cavity is generally formed by thickened and indurated cellular tissue, sometimes by muscular fibres, sometimes by peritonæum. Perforations are not infrequent, and the consequences which they occasion are of the same nature as in the stomach, duodenum, or large intestine.\*

When the ulcers are seated in the isolated follicles, their number is sometimes immense, hundreds of them being scattered in every direction. Under these circumstances, they are generally of small size, rounded, and exhibit every variety of disorganization, from incipient erosion to the complete removal of the gland.

In the glands of Peyer, the ulcers are not unfrequently seen in thick clusters, resembling the confluent eruption of the skin in small-pox. Their surface is often remarkably uneven, granular, or honey-combed,—appearances which are owing, as well to the partial destruction of these follicles as to the hypertrophied condition of the intervening cellular tissue. Frequently I have seen them present an eroded, worm-eaten aspect, with reddened, elevated, and indurated margins. The configuration which these ulcers assume generally resembles that of the glands in which they are situated; that is, they are oblong, elliptical, or circular, and occasionally, as in a case which fell under my observation not long since, they are T-shaped. When several of the patches run together, they are commonly very irregular, and their dimensions are also much greater, the eroding process going on until the mucous membrane is destroyed over a very considerable extent of surface. Occasionally, all the glands of Peyer are in a state of ulceration; more commonly, however, not more than five or six are involved, and sometimes only a single one.

Follicular ulcers are exceedingly common in the small intestines of phthisical subjects. Louis observed them in different proportions, in nearly five-sixths of all the cases which he examined at the Charity Hospital in Paris. Andral found the small bowel sound in only about one-fifth of all the consumptive patients who entered the wards of Lermnier during a period of five years. This proportion differs remarkably from that of Bayle, who met with this lesion in only two-thirds of his cases; but it may be satisfactorily accounted for, by the greater care which Louis and Andral employed in cleansing and thoroughly scrutinizing the whole alimentary tract. Every one who is at all extensively engaged in pathological researches, must fully admit the frequency of this complication. So commonly have I met with it, that I never examine a phthisical individual without expecting to find ulceration of the small or large bowel, or both.

Ulcers of the small bowel, whether originating in the mucous or in the glandular texture, can often be recognized, if they are deep, even before the tube is laid open, from the translucent and discolored state of the peritonæal covering. Often the free surface of the bowel is covered with globules, shreds, or patches of lymph; and, in a few instances, I have seen it studded with small granulations, which accurately defined the seat of the disease. These remarks are equally applicable to deep ulcers of the stomach, duodenum, and large intestine.

I need scarcely say that these ulcers are susceptible of healing. (Pl. VI, Fig. 9.) In the college museum are several preparations which beautifully illustrate this subject. In one of these, the ulcer, about the size of a half-penny,

\* For specimens of ulceration of the isolated follicles, see Plate V, Fig. 9, and glands of Peyer, Plate VI, Fig. 1.



is of a bluish color, and completely cicatrized, with a smooth, slightly-depressed surface. In the same specimen are several other erosions, some of them perfectly raw, others in a state of partial reparation. Very recently, in examining a female who died of phthisis, I found a small ulcer in the ileum, the cavity of which was nearly filled with hard, solid lymph, of a yellow-greenish color, from the intermixture, doubtless, of fecal matter. For the account of the process by which this cicatrization is effected, the reader is referred to what was said upon the subject, under the head of organic disease of the stomach.

Not unfrequently the ulceration of the mucous membrane seems to be consecutive, the suppuration commencing in the subjacent cellular tissue, and elevating the mucous membrane into little abscesses, about the size of a split pea. After a while the covering breaks, and thus an ulcer is formed, which runs the same course as in the preceding case. When several of these purulent collections exist in close proximity, they may communicate by means of fistulous tracts, in the same manner as abscesses of the subcutaneous cellular tissue.

Ulcerations of the small bowel do not, under ordinary circumstances, give rise to any symptoms that can be considered as pathognomonic. In most cases, there is intractable diarrhœa, with tenseness of the abdomen, emaciation, and gradual failure of the strength. The countenance has a withered, wo-begone look; the appetite is variable and capricious; and the patient is harassed with indigestion and great uneasiness after eating. There is seldom any decided pain in the region of the affected bowel, but often considerable tenderness on pressure, with griping and tenesmus. Sometimes there is a peculiar rawness of the mouth and fauces; and cases occur in which these parts are covered with numerous aphthous incrustations. The alvine evacuations are extremely variable. Generally they are thin, watery, and highly offensive; sometimes mixed with blood, sometimes with pus. When the ulceration is combined with thickening and induration of the coats of the intestine, there may be the most obstinate constipation, from the loss of power of the muscular fibres.

2. *Typhoid Fever.*—Inflammation of the glands of Peyer has recently acquired an unusual degree of interest in consequence of an opinion, now pretty general and apparently well-founded, that it constitutes the fundamental lesion of typhoid fever. This disease, which probably occurs in all parts of the world, appears to be particularly common in France, where it was first described, as a distinct affection, by Petit and Serres, in 1813, under the name of “entero-mesenteric” fever. Bretonneau, of Tours, not long afterwards, called it “dothineritis,” from a Greek compound, literally signifying pustular inflammation of the intestine. Andral, Cruveilhier, and others have denominated it “follicular enteritis;” and by the German pathologists it has been noticed under the appellation of “abdominal typhus.” Louis, who has published the most able, comprehensive, and philosophical treatise on the disease that has yet appeared, has described it under the title of the “typhoid affection,” a phrase which has been superseded by that of “typhoid fever,” as more elegant and expressive.

To what extent typhoid fever prevails in this country, is unknown. As an affection, distinct from common continued fever, its existence among us was first recognized by Dr. Jackson and Dr. Hale, of Boston, by Dr. Gerhard, of Philadelphia, and by Dr. Bartlett, formerly of Lowell, now of Baltimore. These distinguished physicians have all published able memoirs on the subject, and have clearly shown that the typhoid fever of the United States is identical with that of France, as portrayed by Louis, Chomel, Andral, and other inquirers.

The disease is often slow and exceedingly insidious in its mode of access.

When fully established, it is characterized by great muscular debility, a dull, vacant expression of the countenance, low, muttering delirium, dry, red, or brownish state of the tongue, black sordes of the teeth, sickness at the stomach, diarrhœa, tympanitic distention of the abdomen, epistaxis, and rose-colored spots on the skin. The latter are present in nearly all cases; they usually appear during the second week of the fever, and continue for six or eight days, when they gradually fade and die away. They are of a lenticular form, about as big as the head of a pin, of a bright red, or rose color, and slightly elevated above the surrounding surface. The abdomen and chest are their most common seat. Their number varies from a few to several dozens. Sudamina, or minute transparent vesicles, are also pretty frequently present, most commonly on the sides of the neck, shoulder, and chest, rarely on the face, abdomen, or extremities. Of the size of a clover-seed or split pea, they are of a circular or oval shape, and filled with a thin limpid fluid: they seldom occur before the end of the second week.

The diarrhœa, although it may begin at an early period, rarely sets in before the second or third week. It is most severe in protracted cases, and may last for fifteen or twenty days. The stools are thin, watery, fetid, turbid, and of a yellowish, or dark brownish color; they seldom contain mucus, but now and then they are mixed with blood, either liquid or grumous. The tympanitic distention may be slight, or so great as to occasion considerable dyspnœa. Like the diarrhœa, it seldom manifests itself before the middle or end of the second week.

Typhoid fever may probably occur at any period of life, but is most common in young subjects, from the twentieth to the twenty-fifth year. It is rare in childhood, and very few cases occur after forty. The duration of the disease is from a week to one or two months, the average being about twenty or twenty-two days. The influence of sex, temperament, season, and occupation, in the production of typhoid, is not determined. The malady has been supposed to be contagious, but this also is an unsettled point. It rarely occurs twice in the same individual.

It is not often that typhoid fever proves fatal before the sixth or eighth day, and hence its anatomical characters, at this early stage, are still imperfectly understood. The first perceptible alteration, as it respects the Peyerian glands, appears to be an unnatural influx of blood, in consequence of which they exhibit a rose, pink, or reddish tint, which is either limited to particular points, or diffused over their entire surface. Contemporaneously with this capillary engorgement, or, at all events, within a short period after its occurrence, the affected parts lose their transparency, and are rendered more or less opaque, as may be seen by dissecting them off, and holding them between the eye and the light. In proportion as the morbid action increases, the discoloration becomes more conspicuous, and the glands are slightly elevated above the level of the adjacent surface, in the form of elliptical, oval, or circular patches, from a few lines to several inches in diameter. At a somewhat later period these bodies exhibit an uneven, granular, mammillated, or honeycomb-like appearance,—evidently from the projection of their follicles,—and their edges, which are hard, everted, and knobby, overlap their base. They are remarkably plump and full, their thickness varies from one to two lines, and their own substance, as well as that by which they are connected to the muscular coat, is more or less softened, infiltrated, and friable. These changes may involve several glands, a single one, or a great number, and they are always more strongly marked the nearer we approach the ileo-cæcal valve.

When the disease has reached the height above described, its tendency is

to terminate in ulceration. At what period this sets in is undetermined. The probability is, that it varies considerably in different cases, beginning pretty early in some, tolerably late in others. In the subjects examined by Louis, it was seldom found, except in a very slight degree, prior to the fifteenth day. The process frequently commences simultaneously at several points, from which it spreads in different directions, until the whole or the great portion of the gland is destroyed by it. Its rapidity is influenced by the severity of the attendant action, by the state of the system, and by various other circumstances, with the nature of which we are unacquainted. The resultant ulcers are of an elliptical, oval, or rounded shape, with hard, smooth, perpendicular edges, as if the patches had been scooped out with a punch. This, however, is not always the case, not even in the same subject. On the contrary, the margins are sometimes quite irregular, jagged, shreddy, knobby, bevelled off, or even partially undermined. The bottom of the sore is grey, ash-colored, pale red, or yellowish, and often covered with the débris of the gland, with lymph, or with lymph and fecal matter. It may be formed by the submucous cellular tissue, by the muscular coat, or even the peritonæal covering, according to its depth or extent. The largest ulcers are always at, near to, or within a few inches of the ileo-cæcal valve. In number they range from four or five to twelve or fifteen. In the early stage of the disease there may not be more than one or two, while at a more advanced period there may be as many as twenty, thirty, thirty-five, or forty. Ordinarily we find well marked ulcers at one part, imperfect erosions at another, tumefied and reddened glands at a third, and perhaps an entire freedom from disease at a fourth. It may be stated, as a general rule, that the higher we ascend in the bowel, or the farther we pass from the ileo-cæcal valve, the less affected will be the agminated glands, and the mucous membrane between them. Fig. 137, from Cruveilhier, shows the ravages, at this advanced stage, of the disease, and the enlarged condition of the mesenteric ganglions.

It is not often that these ulcers erode the peritonæal covering, and so lead to perforation. Nevertheless such an occurrence is occasionally met with, and is always rapidly fatal. The perforation is generally single, from two to three lines in diameter, irregularly rounded, and near the ileo-cæcal valve. It is most frequent in the milder grades of the disease, and commonly takes place during convalescence, or when the patient is considered as out of danger.

When death occurs early, before the establishment of ulceration, the submucous cellular tissue of the affected glands is sometimes converted into a hard, friable substance, of the consistence of crude tubercle or solid cheese; it is of a pale pink or yellowish color, destitute of any trace of organization, and exhibits a dry, glossy surface when cut. This appearance has been noticed

Fig. 137.





by Louis in somewhat less than one-third of his cases. Professor Bartlett also noticed it in several subjects, during the grave epidemic of 1833-4, in the city of Lowell. The cause of this transformation is unknown.

The small bowel is moderately distended with air, and usually contains more or less mucus tinged with bile. The duodenum and jejunum are almost constantly healthy. The alterations of the mucous tissues of the ileum, in the intervals of elliptical patches, are various. In a considerable proportion of cases, the isolated follicles are reddened, softened, and enlarged to three or four times the natural volume. After the second week they are occasionally found ulcerated, cedematous, or infiltrated with purulent matter. These changes are always most strongly marked in the lower portion of the tube. The mucous membrane itself is, in a majority of instances, more or less altered in color. In many it is red, not continuously, but in patches or zones; in some it is greyish, and in a few it is unusually pale. Its consistence also varies. It may be perfectly natural, or so slight as to escape attention; more frequently, however, it is diminished, and this may be so considerable as to enable us to scrape off the membrane with the greatest ease, or to convert it into a soft, pulpy substance, not unlike thin currant jelly. The discoloration and loss of cohesion may coexist, or they may occur independently of each other.

In some cases the mucous membrane is the seat of sanguineous infiltration. This condition may exist to the extent only of a few inches or of several feet. It is generally continuous, not in patches or zones. The color of the affected membrane ranges from a rose to a very dark red, and it has a peculiarly brilliant and trembling or quivering appearance, like jelly. Chomel, who found this lesion in seven of forty-two cases, is confident that it is intimately connected with hemorrhage from that portion of the tube which it occupies.\*

There is hardly a case of typhoid fever that lasts beyond the sixth or eighth day in which the mesenteric ganglions are not more or less seriously involved. Whether they are affected simultaneously with the glands of Peyer is not certain. The irritation seems to extend from the mucous membrane along the lymphatic vessels in the same manner as it does along those of the penis in chancre. The affected ganglions are increased in size, of a rosy, red, or purple color, and so soft that they may be readily broken down with the finger. In a few rare cases they contain purulent matter. These changes usually coexist, and accurately correspond with the diseased patches. Those opposite the healthy glands are sometimes affected in the same way. Immense numbers of these bodies are occasionally involved. The irritation not unfrequently spreads to the meso-colic ganglions, which, however, are seldom affected in the same degree as the mesenteric.

The spleen is hardly less frequently or less seriously affected than the glands of Peyer and the mesenteric ganglions. Louis found the organ healthy in only four of his cases, and these occurred in individuals who died after the twentieth day. Hence the probability is that it is in reality implicated in every instance at an early stage of the disease. The most constant alteration is an augmentation of its volume, which is often three, four, or even five times the normal standard. It is also very generally diminished in its consistence. The softening varies in degree from slight loss of cohesion to complete pulpiness. These two changes may occur separately, but more frequently they coexist, and are always more strongly marked in proportion to the rapidity of the disease. Along with them are observed various alterations of color, of which the most constant are dark brown, bluish, black, or livid. The changes here described

\* Bartlett, *op. cit.*, p. 59.

are not limited to particular portions of the *spleen*, but affect it universally and equably throughout.

The large intestine is meteorized and ulcerated. Gas is present in a large proportion of cases, and may be so copious as to produce excessive distention of the abdomen, with corresponding difficulty of breathing. Ulcers exist in one patient out of three. They are small, not numerous, superficial, and most abundant in the cæcum and ascending colon. The villous membrane may be sound throughout, or it may be reddened, thickened, or diminished in consistence. In a small proportion of examples the submucous cellular tissue of the isolated follicles is converted into a hard, curdy, yellowish substance, similar to that spoken of under the head of the elliptical patches.

The stomach is free from disease in about one-third of the cases of typhoid fever. In the remainder the mucous membrane is variously affected, that is to say, it is reddened, diminished in consistence, increased in thickness, mammillated, or ulcerated. These changes may exist independently of each other, or, as more commonly happens, two or more may occur together.

The pharynx and œsophagus are not often affected. The only lesion to which they appear to be at all subject in this disease is ulceration, which occurs in about one-fifth of the cases. The erosions are usually very superficial, of a circular or oval shape, and from one to six or eight lines in diameter.

The liver does not seem to be oftener affected in this than in other acute diseases. Andral found it almost constantly healthy. Louis, on the contrary, discovered it to be softened in nearly one-half his cases; as the change, however, was most frequent during the warm season, it is not improbable that it was produced, at least sometimes, by putrefactive decomposition. It may be unnaturally pale, or it may be dark, reddish, or engorged with blood. The bile is very abundant, fluid, reddish, or greenish. The gall-bladder, in a few rare cases, contains pus, and its mucous membrane is sometimes manifestly inflamed. The pancreas, salivary glands, urinary apparatus, and genital organs are usually healthy.

The lungs are natural in about one-fourth of the cases. Louis found them healthy in fifteen of forty-six cases; Chomel, in ten of forty-two. The most constant alteration is a carnified state of the parenchymatous substance, which is tough, leathery, and of a dark-red or livid color; it is destitute of air, readily sinks in water, and is with difficulty broken down with the finger. "When cut, the smooth surface is directly covered with a thick, red fluid. This peculiar lesion almost always occupies a circumscribed portion of the lower and posterior lobe of one or both lungs. It is quite unlike, in almost every respect, the second stage of inflammation, although the term hepatization has sometimes been applied to it."\* The mucous lining of the bronchial tubes is often unnaturally red: the trachea and larynx are sound, but the epiglottis is sometimes ulcerated or denuded: the pleural cavity, in many cases, contains an effusion of bloody serum, varying in quantity from a few ounces to a pint or more, occupying both sides of the chest.

The heart is natural in about half the cases. The principal change which it experiences is a loss of consistence, which is sometimes so great that the muscular tissue may be readily torn and broken down. Conjoined with this there is generally a departure from the natural color, which is either pale, deep red, violet, or livid. The lining membrane of the aorta is frequently

\* Bartlett's History, Diagnosis, and Treatment of Typhoid and of Typhus Fever, p. 51. Phila. 1842.

found reddened, probably from the imbibition of the hæmotosine. The blood drawn during life rarely exhibits the buffy coat, it coagulates imperfectly, and there is always a considerable diminution in the natural proportion of fibrin. When the buffy coat is present, it is unusually thin, of a soft, jelly-like consistency, and of a greyish or greenish color. The blood in the cavities of the heart may, as, indeed, it frequently is, be black and fluid, or it may be clotted or grumous. Occasionally it is converted into fibrinous concretions. When fluid, it may contain bubbles of air.

The brain is more rarely implicated than the severity of the symptoms might lead us to infer. The medullary substance is moderately injected in a majority of cases, and the cortical is often more or less red. The pia mater may be uncommonly vascular, and the subarachnoid cellular tissue is frequently œdematous, or infiltrated with serosity. The ventricles and the serous sac on the surface of the brain occasionally contain a few drachms of clear, or slightly turbid, water.

3. *Hypertrophy*. — This affection is generally the result of chronic irritation, leading to an effusion of lymph into the connecting cellular substance. The intestinal tunics may be from three to six lines in thickness, and of almost fibro-cartilaginous hardness. The part of the small bowel most subject to hypertrophy is the lower end of the ileum, where it commonly occurs in particular spots. The affection is often attended with stricture, carried to such a degree sometimes as almost to close the natural passage. In these cases, the gut above the seat of the contraction is often enlarged to three or four times the ordinary capacity. One of the most extraordinary examples of this dilatation perhaps on record was related some years ago by Dr. M. H. Leon,\* of Columbia, South Carolina. It occurred in a young woman, aged twenty-five, who had labored for a considerable period under scirrhus of the rectum and uterus, and who had not had any alvine evacuation for the last nine weeks preceding her dissolution. On examination, the whole intestinal tube was found to be enormously dilated, the colon measuring thirteen inches and a half in circumference; nor were the duodenum and ileum any less. Every where marks of high inflammation were discovered, and the valvular structure was completely effaced. The quantity of fæces amounted to nearly seven gallons, and the long retention of it was no doubt the immediate cause of this extraordinary enlargement. The stomach was much contracted, and its coats highly inflamed and thickened.

In another case, the particulars of which are given by Dr. Mason L. Weems,† of Washington city, the dilatation was limited to a small portion of the ileum, which was expanded into hollow, ovoidal sacs, from three to five inches in diameter. The parietes of these pouches were upwards of six lines in thickness, of a white pearly color, and remarkably friable in their texture, exhibiting, when torn, a fibrous, striated arrangement. The subject of this case was a boy between six and seven years of age. No cause could be assigned for the diseased state of the bowel.

4. *Atrophy*. — Another occurrence of the intestinal coats is *atrophy*. Bonetus informs us that he has seen the bowels as thin as a cobweb; and Professor Chapman states he has found the ileum so much wasted away that there was scarcely any thing left excepting a most delicate peritonæal covering, expanded over a few pallid and widely-separated muscular fibres. Such an extreme attenuation of the coats of the bowels I have never witnessed; nor

\* Amer. Jour. Med Scien., vol. ii., p 334.

† Ibid., vol. xvi., p. 246.



can it be supposed to be of frequent occurrence. A sort of general atrophy seems occasionally to pervade the alimentary tube. Tartra describes the case of an individual who died three months after swallowing a considerable quantity of nitric acid, in whom the bowels were reduced to a very small volume, their coats shrivelled and indurated, and their caliber throughout not larger than a common goose-quill. Large quantities of lymph effused from the peritonæal surface and agglutinating the bowels together, is sometimes another source of atrophy of these organs.

5. *Tubercle*-Conjoined with ulcers of the small intestine, or occurring without them, are occasionally to be observed small *tubercles*, seated either in the submucous cellular tissue, amongst the muscular fibres, or between them and the peritonæal covering. Varying in size from a mustard-seed to a common pea, they are often equally dispersed over the circumference of the bowel, and are almost always most numerous in the lower half of the ileum. What is remarkable, these small bodies are extremely rare in the stomach, duodenum, and colon, — so much so, that some writers have denied, though without reason, their existence. Louis, who has given a very able account of intestinal tubercles, has distributed them into classes, founding his division upon their difference of density. This, to say the least, is an unnecessary degree of refinement; for that all tubercles, no matter where occurring, are at one period solid, is as fully established as that they have a tendency ultimately to become soft. Thus, then, cases will frequently present themselves in which some of those bodies are semi-cartilaginous, whilst others are in a state of suppuration.

These bodies are very common in phthisical subjects. Louis observed them in thirty-six patients out of ninety-five, or in upwards of one-third of all his cases. I cannot think, however, that they are so common in this country: in my own dissections, I have not often met with them; nor can I find that they have been frequently witnessed by the Philadelphia pathologists, whose reports of examinations are certainly equal, in point of accuracy and copiousness of detail, to those of any physicians in the United States. In the human subject, these bodies, as has been already intimated, seldom attain any considerable magnitude: in some of the inferior animals, however, especially in the horse, they may acquire the bulk of a small orange, their interior being hollow, or, as is more generally the case, partially filled with sebaceous matter, resembling that of the cutaneous follicles.\* When the covering of intestinal tubercles gives way, a corresponding number of ulcers is formed, with white, opaque, and indurated edges. Such erosions are always peculiarly loth to heal; in which respect they afford a striking analogy with those produced by the same cause in the lungs. There are no symptoms which are peculiar to intestinal tubercles.

Tubercles of the intestines are not peculiar to the human subject. I have noticed them in different classes of quadrupeds, particularly in the horse, ox, and sheep, in the latter of which they are exceedingly common, especially in the Western States. The number of tubercles in this animal is sometimes immense: they occur throughout the whole length and breadth of the intestinal tube, and, as in the human subject, most of them are situated in the submucous cellular tissue. Their volume varies between a millet-seed and a pea; but, by their agglomeration, they often form large nodules, which are particularly conspicuous along the line of attachment of the mesentery and meso-colon. In their color, these bodies are usually of a greenish-grey; and, in their consistence, they range between soft putty, fibro-cartilage, cartilage, and bone.

In making examinations, opportunities occasionally occur for observing dif-

\* Andral, *Pathological Anatomy*, vol. ii., p. 113.

ferent morbid growths in the small intestine. Amongst these, the most important are polypous, fungous, and eareinomatous tumors; none of which, however, as they do not differ materially from such as occur in the stomach, need be here particularly described. They are all extremely rare, and I have never met with them.

6. *Milt-like Tumor*. — No mention has yet been made of the *milt-like tumor* of the mucous membrane, so well described by Professor Monro, of Edinburgh. I do not know whether it has ever been found in the stomach; but, as it has been repeatedly seen in the bowels, especially in the small, the present seems to me to be the proper place for making a few remarks upon it. In color and consistence this tumor bears a striking resemblance to the milt of a fish, whence its name. It has an irregular surface, adheres but slightly to the part upon which it grows, and is wrapped in a thin, delicate membrane, in which are to be seen numerous vessels filled with blood. Its consistence is such that it very readily falls to pieces; and, on being squeezed in water, it forms with it a turbid mixture.

This species of tumor generally attains a considerable volume, and, in some instances, almost fills the intestinal tube. Its progress is usually very slow, and hence the individual may live for years, the bowel gradually widening and accommodating itself to its pressure. Its attachment is effected by a number of small, fibrous processes; and, when these are divided, it is not unusual to find the villous coat exhibiting a honey-comb appearance. Such is a brief outline of what Professor Monro has been pleased to denominate the *milt-like tumor*, — a morbid product, which, although I have never seen an example of it, is, in all probability, merely a variety of medullary sarcoma.

7. *Melanosis*. — This substance is occasionally observed in the alimentary tube. Its most common seat is in the small bowel, but it may occur indiscriminately throughout the whole intestinal tract. The quantity deposited is various; in general, however, it is very trifling. The black matter assumes different shapes, occurring either in thin, stratified patches, or in the form of small, flat, rounded tumours, some of which are occasionally encysted. Most usually this substance is accumulated in the cellular tissue between the peritoneal and muscular tunics; sometimes, however, it is found upon the free surface of the bowel, and instances have been known where it was seated in the submucous texture.

Small, brownish, mahogany, or slate-colored stains are sometimes met with in the villous and follicular structures of the intestines, produced either by a stagnation of the blood, or by this fluid having been subjected to the action of some acid. They are often seen in cases of chronic irritation, and are particularly conspicuous in the glands of Brunner and of Peyer, the former of which are occasionally completely encircled by them. These stains are liable to be confounded with those resulting from melanotic infiltration, but may be easily enough distinguished from them by the fact that they do not, like the latter, soil the finger when washed in clear water.

8. *Concretions*. — Earthy concretions sometimes form in the bowels, but much less frequently in the human subject than in some of the inferior animals. Their size is extremely various. Sometimes they do not exceed a garden pea; at other times, however, they are as large as an orange; and Monro refers to a case where a body of this kind, taken from the colon of a woman, weighed four pounds. In the inferior animals, their bulk is occasionally enormous. Thus, Dr. Voight, a German writer, gives an instance of an alvine concretion in a horse which weighed thirteen pounds.

Although there are seldom more than two of these concretions, yet in some cases they are quite numerous, as many as ten or fifteen being found in one

person. They are generally of a globular shape; and, when there are a good many of them, they are apt to be a little flattened at the sides, probably from the friction which they exert upon each other. They are of a brownish color, feel soft, but are too hard to be compressed, and have altogether a porous, spongy appearance. On breaking a section of them, these concretions are found to be composed of an immense number of small fibres which are intimately interwoven with each other like the felt of a beaver hat, the intervals between them being filled up by earthy matter. In most cases, these fibres are arranged in distinct lamellæ, the external of which are about two lines in thickness, and are generally of a lighter color than the internal. Each concretion is commonly provided with a central nucleus.

In their chemical constituents, these concretions present considerable variety. Mr. Children gives an account of some which were composed of albumen, common salt, phosphate of lime, and phosphate of soda. Dr. Marcet describes them as possessing the properties of soft cheese, and Mr. Brande as being made up entirely of the carbonate of magnesia. Thus, their ingredients may be supposed to vary in different cases, and to be scarcely ever precisely alike in any one instance.

These concretions are most frequent in Scotland, where they owe their origin to the oats so much employed by the lower orders as an article of food. But almost any extraneous and indigestible substance may serve as a nucleus to these bodies. Dr. James Murray,\* of Dublin, in an interesting paper upon this subject, states that alvine concretions often accumulate around fragments of almonds, nut-kernels, grape and cherry-stones, pieces of radishes, and even tea-leaves. Occasionally they are caused by the long-continued use of magnesia. Mr. Brande has published a case in which this substance was impacted in the colon to the amount of three pounds.

Other concretions are sometimes found in the intestinal tube, very different from those just described. They are mostly observed in dyspeptic subjects, or in those who suffer habitually from a torpid state of the bowels and derangement of the assimilative functions. What their precise constitution is, has not been ascertained, nor do we know any thing satisfactory respecting the nature of their origin or the mode of their development. These concretions are, in some instances, of an irregular shape, of the consistence of inspissated tallow, slightly translucent, and of a greyish drab color; in others, they are of a globular form, nearly or quite opaque, of an adipocirous or waxy character, and of a pale yellowish, whitish, or cineritious hue. In size, they vary between a small pea and a large grape; and they rarely if ever have any proper nucleus, though they are often much harder at the centre than at the circumference.

9. *Fatty discharges.* — To the above account of calcareous and other concretions, may be added a few remarks on *fatty discharges* from the bowels. Although this subject was incidentally noticed by some of the earlier physicians, as Tulpus and Fabricius Hildanus, it does not seem to have attracted the special attention of the profession until within a comparatively recent period. For our knowledge concerning it, we are principally indebted to two distinguished English pathologists, Dr. Bright and Dr. Elliotson, whose excellent papers on this disease, first published in the *Medico-Chirurgical Transactions of London*, comprise a great mass of highly interesting and valuable matter, of which I shall freely avail myself in this brief notice.

The form in which this fatty matter presents itself is exceedingly various. Sometimes it has all the properties, apparently, of oil, being perfectly liquid,

\* *Medical Lancet*, July, 1836.



specifically lighter than water, and of an inflammable nature ; at other times, it is semi-concrete, or of the consistence of tar, thick treacle or jelly, and of a pale straw color. Very frequently, it comes away quite fluid, but acquires an immediate increase of consistence on exposure to the atmosphere. The quantity evacuated is also liable to considerable diversity. In the interesting case below, communicated to me by my friend Dr. J. B. S. Jackson, Boston, it amounted, on an average, in the twenty-four hours, to about eight ounces, during more than four months. The quantity is often much less ; and, on the other hand, it may be much greater. In a case recorded by Dr. Johnson, in the *Medico Chirurgical Review*, the patient ejected, in a short time, the enormous amount of thirty pounds : he had fasted for several days, when he eat voraciously of indigestible food, which soon excited vomiting, at first of blood, and subsequently of fatty matter. He recovered in less than a month, but not without great loss of bulk.

I am not aware that any analysis has been made of this fatty matter. In a specimen examined by Dr. Prout, it possessed all the properties of human fat ; and, in another case, it is said to have formed good soap on being mixed with alkali. In the generality of instances, it has a fetid odor ; but occasionally it is perfectly pure, wholly devoid of smell, and capable of protracted preservation.

Although these fatty discharges have been observed at different periods of life, yet it would appear from an attentive examination of the cases of it on record, that they are much more frequent in the aged than in the young. What their source is, or the particular condition of the system which favors their occurrence, are points concerning which we are in total ignorance. In nearly all the cases published by Dr. Bright, there was a remarkable similarity in the pathological phenomena. The most prominent symptoms were jaundice, enlargement of the liver, and evacuations of fatty matter from the bowels. On dissection, organic lesion was found in the pancreas, liver, and duodenum, with obstruction of the gall-duct. In a case mentioned by Mr. Lloyd, of England, there was disease of the head of the pancreas, with closure of the Wirsungian duct, by calculous concretions, and contraction of the duodenum. During life, the same symptoms were noticed as in the examples reported by Dr. Bright. Instances of a similar nature have been published by Scott, Elliotson, Babington, and other writers. In a few cases, the fatty substance coexisted with pulmonary phthisis, hysteria, and diabetes, and proceeded simultaneously from the bowels and urinary bladder.

To what source, then, are these singular discharges to be ascribed ? Do they proceed from the pancreas, from the liver, or from the gastro-enteric mucous membrane ? Dr. Bright, from his dissections and observations, is inclined to believe that they are the result of a morbid secretion of the pancreas, — an opinion which has since been adopted by several highly respectable pathologists. Others, again, refer them to the liver, alleging that they are merely an abnormal increase of the fatty secretion which that organ performs in the healthy state. Without entering at all into the merits of these questions — which my limited space does not admit of — it will be sufficient to observe that there are numerous examples of this disease on record, which cannot possibly be explained by a reference to either of these organs. We have already alluded to the interesting case of Dr. Lloyd, in which the pancreatic duct was completely obstructed by calcareous matter, and we shall have occasion, presently, to mention another of a similar description, by Dr. Jackson. That they do not proceed from the liver, is abundantly shown by the fact, that, in persons who labor under this affection, the biliary

channels are sometimes so completely choked up as to prevent any thing from passing along them to the duodenum. Since, then, this fatty matter is not furnished by the pancreas and the liver, whence does it emanate? Is it poured out by the mucous membrane of the stomach and bowels? Here, again, the pathologist is at a loss for proof. Nevertheless, it appears highly probable, when we take into consideration the circumstance that these evacuations are occasionally attended by very great and rapid emaciation, that they are the result of a sort of metastasis of the secretion of fat of other parts of the body, in which it is naturally deposited, to the surface of the alimentary canal. This opinion, which has been ingeniously advocated by Professor Stokes,\* of Dublin, although not free from objection, affords, perhaps, the best explanation that can be offered in the present state of the science. My own idea about these fatty discharges is, that they are a morbid secretion of the mucous membrane of the stomach and bowels, which is often greatly modified and influenced by organic disease of the liver, the pancreas, and the duodenum.

I shall close this subject with the following case, already several times alluded to, which exhibits, in detail, the symptoms and autopsic condition ordinarily observed in the disease under consideration. I shall present it in the language, nearly, of the intelligent physician, Dr. J. B. S. Jackson, who kindly communicated it to me, and whose zeal in the pursuit of pathological science is well known to the profession. The patient, a laborer, forty years of age, died on the 16th of September, 1837. Thirteen years before, he had an attack of hemorrhage from the bowels, by which he was greatly reduced, and to which he always referred his disease. Little was known of him from that time till about three years before death, when he had a second attack: the discharges of blood, which were very large, continued more or less for six or eight weeks, with diarrhœa, from which he recovered so far as to resume his work. He had constantly, however, great soreness and tenderness in the epigastric region, so that, at times, he could not bear the weight of the bed-clothes, and he always had his dress made loose, that it should not press on the stomach. He had also frequent returns of diarrhœa and bloody discharges from the bowels, which last, he said, usually afforded him temporary relief: his appetite was good, and the digestive function not particularly impaired. Thus he continued till December, 1836, nine months before death, when, after working all day in a damp cellar, with his coat off, he was seized with symptoms of fever, pain, and obstinate constipation, the latter of which, after persisting for several days, was followed by severe diarrhœa. The evacuations from the bowels were one half blood, and there was great pain, with extreme tenderness in the epigastric region. In about a fortnight, he began to have discharges of fatty matter in a liquid state, resembling, when cold, yellowish tallow, and estimated by himself to amount, on an average, to eight ounces in the twenty-four hours. This substance accompanied every dejection, but there was none in the urine, and it continued until May, when it entirely ceased: the feverish symptoms disappeared in two or three weeks, but not so the pain and tenderness. He, however, went to work, taking laudanum whenever there was a paroxysm of pain. After eating, no matter how small the quantity, there was always a sense of fulness and tightness in the stomach, followed by the most excruciating pain, copious perspiration, dyspnœa, nausea, and often vomiting. These attacks usually lasted from four to five days, required large doses of laudanum for their relief, and always went off gradually; recurring, at first, every eight or

\* London Medical and Surgical Journal, March, 1834.

ten days, but afterwards, as the disease progressed, at shorter intervals. The discharges from the stomach and bowels, in whatever way produced, were uniformly light-colored and clayey from December until he died. The appetite, for the first five months, was generally good, — indeed, often craving; after that, it became indifferent; five weeks before death the skin assumed a yellowish cast. A physician, who was called in about the last of August, found the abdomen extremely tender, with a tumor in the epigastric and right hypochondriac regions, extending nearly to the umbilicus; the perspiration, urine, skin, and conjunctiva, were of a yellow color, the latter deeply so; the dejections were free from bile; and the lungs presented signs of advanced tubercular disease. From this time on, there was little pain; the cough was slight; and the man sat up every day till a short time before death. When in bed, he always lay on the right side, with the body bent forward. On the 16th of September, he was comatose, but could still be roused, and said he felt better. Early in the afternoon of that day he expired.

On opening the cavity of the abdomen, a large fluctuating tumor, of a regular oval form, was at once seen below the right lobe of the liver, with which it was closely connected by old adhesions: it was situated between the intestines and the posterior parietes of the abdomen, and extended towards the left side a short distance beyond the spine; the duodenum ran over, and almost around it. On making a free incision into it, the tumor was found to contain, by estimate, from ten to fourteen ounces of a red fluid, without coagula, not viscid nor greenish, and without any appearance of fatty matter. Branches of the cœliac artery were traced, and found healthy. The tumor or cyst, after removal from the body, measured four inches by three, — its walls being from one to three lines thick, of a reddish color, membranous, and fleshy to the feel. Nothing could be discovered like the structure of the pancreas, yet the parietes of the cyst were evidently formed by a dilatation of that organ, as they contained several very minute calculi. The inner surface was for the most part firm and smooth, but on the side towards the duodenum, it was, to a small extent, irregular, soft, and apparently disorganized: two calculi adhered to it near the opening of the duct, which was entirely obliterated: they were several lines in diameter, rough on the surface, and had the usual characters of pancreatic concretions. There was a third, also, but much smaller. The remainder of the pancreas, forming the left extremity of the organ, was about two inches in length by two-thirds of an inch in width, contracted, irregular, and very hard, as if filled with small calculi. The duct itself was considerably enlarged, and opened freely into the cavity of the sac. There was no appearance of malignant disease about the tumor, nor, indeed, in any part of the body. The stomach, small and pushed high up in the abdomen, contained some thin liquid, of a light but decidedly yellowish color. About seven feet of the ileum were opened, but there was no trace of bile. The liver was small, dark-colored, and thrust high up by the tumor. The gall-bladder was large and distended with moderately thick bile, of a dark green hue. The biliary ducts were dilated and full of bile, without any particular obstruction. The common duct was traced freely into the duodenum: on slitting it open, a portion of it, which formed a part of the parietes of the cyst, was found in a very sloughy condition, similar to the contiguous portion of the morbid mass. The gangrenous part was about an inch long, without involving the whole caliber of the tube, of a greyish-brown color, extremely soft, ragged, and ready to give way.

10. *Laceration.* — A few words may be said here respecting *laceration* of the bowels from external violence, more especially as the subject closely connects itself



with ulcerative perforation, and is one, moreover, of no little interest in a medico-legal point of view, apart from any pathological consideration. All the membranous viscera, properly so termed, appear to be liable to this lesion, though not in an equal degree. Accidents of this kind are usually produced by kicks or blows, and, as they are always followed by an extravasation of the contents of the affected organ, they speedily terminate the existence of the patient.

It is a remarkable fact, and one for which it is not easy to offer any satisfactory explanation, that most of the cases of this accident of which we have any record, affected the jejunum, or the superior portion of the ileum. Another circumstance worthy of notice is, that the bowel may be very much lacerated by external violence without any discoloration or bruises of the abdomen. The subject may be further illustrated by examples, of which I select the following, as having fallen either under my own observation or that of my medical friends.

A coachman, twenty-two years of age, received a kick from a horse upon the left side of the abdomen, between the diaphragm and the crest of the ileum, of which he died in thirty hours. There was no sign of contusion on the skin; but, on dissecting up the integuments, Professor Drake found an extravasation of blood between the oblique muscles, near the junction of their fleshy and aponeurotic parts, which at once indicated the spot upon which the blow had been inflicted. A large quantity of gas escaped from the abdominal cavity, which, moreover, contained upwards of two quarts of fluid feculent matter, of a turbid yellowish color, without any admixture of blood. The peritonæum was universally inflamed: the bowels were closely agglutinated to each other and to the surrounding parts; and in the upper portion of the jejunum, about eighteen inches from the duodenum, were two rents, with thickened, ragged, and everted edges, one of which extended one-third, the other nearly entirely, across the tube. The mucous membrane was but little inflamed. The cellular substance over the second and third lumbar vertebræ was infiltrated with blood, and the left psoas muscle had a swollen and lacerated appearance.\*

In another case, that of a young man of twenty, the injury was occasioned by the blow of a brick-bat thrown from a short distance. Death occurred in forty-two hours. No mark of external violence was discoverable either on the skin or in the abdominal muscles. On opening the peritonæal cavity, Dr. Joshua Martin, of Xenia, to whom I am indebted for a history of the case, as well as for the specimen, detected, in the superior division of the ileum, an oval aperture, about three-quarters of an inch in diameter, through which had escaped a large quantity of fecal matter, giving rise to violent inflammation of nearly the whole of the serous membrane. The bowels were every where incrustated with coagulating lymph, and the same substance thickly adhered to the everted margins of the wound, as well as to the mucous membrane immediately around.

The following case fell under my own observation. A gentleman, sixty-one years of age, while riding in a gig out of a livery stable, came in collision with a wagon, by which his vehicle was upset, and he himself thrown with considerable force upon the ground. What particular part of his body struck could not be ascertained. He was able to walk immediately afterwards, and did not appear to be much hurt. In a few minutes, however, he was seized with violent pain in the umbilical region, which gradually extended to the chest, and continued without intermission until he expired, thirty-six hours from the accident. The other prominent symptoms were, pallor of the countenance, a

\* Western Journal of the Medical and Physical Sciences, vol. i., p. 550.

small and frequent pulse, urgent thirst, constipation of the bowels, and towards the last, occasional vomiting of bilious matter. There was no restlessness, and only slight tympanitis.

On opening the abdomen, the subcutaneous cellular tissue of which was loaded with a thick layer of fat, a small quantity of fetid gas escaped. About a pint of serous, feculent fluid was contained in the right hypochondriac region and among the folds of the intestinal convolutions, which were extensively adherent, and, together with the parietal portion of the peritonæum, every where in a state of intense inflammation. The omentum was prolonged, on the right side, into an old hernial sac, and was throughout of a reddish purple color. In the ileum, two feet and a half from the ileo-cæcal valve, was an opening, with irregular but not ragged edges, horizontal, and scarcely as large as a goose-quill, which had permitted the escape of the fecal matter, and at once explained the cause of the fatal mischief. The mucous membrane was not everted, and the margins of the aperture had already contracted adhesions with the surrounding parts. The coats, both of the small and large bowel, were perfectly healthy. The quantity of fecal matter was not unusual. Not the slightest abrasion, contusion, or discoloration was observable upon the skin of the abdomen.

In all these cases, as well as in every other of which I have any knowledge, the symptoms which supervened upon the injury were of the most urgent kind, and such, precisely, as accompany perforation of the bowels from ulcerative action; that is to say, rapidly developed, and speedily fatal, peritonitis.

11. *Internal Strangulation* of the intestines may take place in different ways, and under a great variety of circumstances. A knowledge of this fact suggests the propriety of arranging it under the following heads: — 1, strangulation from the development of a membranous band, from the attachment of one portion of bowel to another or to an adjoining organ, or from unnatural adhesions of the free extremity of the vermiform appendage, omentum, or Fallopian tube: 2, from the rotation of the canal on its own axis, or round an axis formed by the mesentery: 3, from one portion of bowel compressing another: 4, from the intestine slipping into an abnormal aperture in the omentum, mesentery, or mesocolon: 5, from the pressure exerted on the canal by a tumor, an enlarged ovary, or a diseased uterus: 6, from one piece of bowel falling within another, constituting what is called intussusception. This classification is more extensive than that of Jobert or Rokitansky, and comprises all the forms of internal strangulation of which I have any knowledge.

I. The first species of strangulation is the most frequent of all, and may be produced by the formation of a membranous band, the vermiform appendage, a process of the omentum, a diverticulum of the ileum, or the Fallopian tube.

a. The formation of membranous bands is exceedingly common, and numerous cases of internal strangulation from this cause are upon record. There may be several such bands, but the constriction is usually produced by a single one, varying in length from six or eight lines to two, three, or even four inches. It is often of unequal size, and sometimes scarcely as thick as a pack-thread. It may be perfectly smooth, transparent, and ribband-shaped, or rough, opaque, and rounded like a cord. In its consistence it varies from that of recently organized lymph, out of which it is formed, to that of cellular substance, serous membrane, or fibrous tissue. Its extremities, which may be bifid, or divided into several processes, observe no regularity in regard to their points of attachment. Both may be inserted into the mesentery, or one into the mesentery and the other into the bowel; sometimes they are connected with two coils of

intestine, and occasionally, again, though more rarely, they extend from the surface of the alimentary tube to an adjoining organ, or to the wall of the abdomen. Dupuytren met with a case where both extremities of the membranous band were attached to the wall of the abdomen, just above the inguinal ring, forming an aperture which was traversed by a portion of the intestinal canal.

This variety of strangulation is most common in old subjects, but may take place at any period of life. Dr. Paramore, of Eaton, Ohio, communicated to me, a few years ago, the particulars of a case of this kind, which occurred in his own child, a boy twenty-one months old. It lasted three days, and was marked chiefly by irritability of the stomach, with obstinate constipation and pain in the abdomen, but no tenderness on pressure. A band of false membrane, about one inch and a half long, extended over two coils of the ileum, which were thus firmly constricted and deprived of their vitality. Its extremities were attached to the mesentery, opposite the lumbar vertebræ.

*b.* The vermiform appendage, by contracting adhesions with the surrounding parts, may become a source of strangulation. The attachment may take place to a loop of the small intestine, the sigmoid flexure of the colon, omentum, mesentery, rectum, urinary bladder, the uterus, ovary, or wall of the abdomen. The appendage may retain its natural appearance, or it may be flattened, diminished in size, and transformed into a solid ligamentous cord. A very interesting case, in which the cæcal appendix was attached to the uterus, came before me, some years ago, in a young married female, twenty-two years of age, whom I attended with the late Dr. Herron, of Cincinnati. Up to the period of her confinement she had enjoyed excellent health; but, twelve days after this occurrence, she was seized with severe peritonitis, attended with excessive irritability of the stomach, and the most obstinate constipation of the bowels. These symptoms persisted, without any decided abatement, until the ninth day from the attack, when she died in a state of complete exhaustion. On dissection the serous membrane of the abdomen was found to be extensively inflamed; there was a copious deposit of lymph upon the pelvic viscera; and the vermiform appendage, the extremity of which was firmly agglutinated to the side of the uterus, passed over a loop of the ileum, and thus effectually intercepted its contents.

*c.* In the third form of this species of strangulation the mischief is caused by a diverticulum of the alimentary tube. The preternatural process, which is always the result of a congenital vice, is usually connected with the lower portion of the ileum, to which it forms a sort of appendage, from two to six inches in length, terminating in a cul-de-sac, like the finger of a glove. It is composed of the same number of coats as the canal from which it arises, but is generally somewhat narrower. Two or three such processes are sometimes met with in the same subject. In the natural state the diverticulum is free and floating like the rest of the alimentary canal, it is liable, from disease of its peritonæal covering, to form attachments to the surrounding organs, and may thus become a cause of internal strangulation, in the same manner as a fibrous band, the vermiform appendage, a process of omentum, or the Fallopian tube. Moscati\* relates the case of a man, thirty-three years of age, whose death was occasioned by a diverticulum five inches long, funnel-shaped at its commencement, and terminating in a narrow ligamentous cord, which passed twice around the ileum, and then connected itself with the mesentery.

*d.* A number of examples of strangulation of the bowel from morbid adhesions of the omentum are on record. Professor Monro,† of Edinburgh, men-

\* Mem. de l'Acad. Royale de Chir., t. iii., p. 427. Paris, 1819.

† Morbid Anatomy of the Gullet, &c., p. 173. 1830.



tions five cases which fell under his own observation, and he alludes to another which was communicated to him by one of his medical friends. Examples are also narrated by Arnaud, Klannig, Gisbert de Witt, and Sæmmering. The omentum may be unnaturally elongated, or its free extremity may be divided into a number of narrow-pointed slips. In either case, it may contract adhesions with the surrounding parts, as the uterus, urinary bladder, ovary, mesentery, spine, or wall of the abdomen; and thus afford a barrier, on some occasions, to the course of the fæces, followed by distension, inflammation, and strangulation of the bowel. In two of the cases related by Monro the intestinal canal was constricted at three different points by as many band-like processes of the omentum. Albert\* gives an instance where the small bowel was strangulated by a slip of mesentery.

e. Leblanc† has recorded a case of intestinal strangulation produced by the peduncle of a fatty tumor, developed in the cellular tissue of the mesentery of a mare. The peduncle was of an elongated shape, and, after completely surrounding the bowel, was inserted into the left side of the mesentery. The animal died after having suffered for fifteen hours with violent colic.

f. In the case of a child, three years old, described by Howship,‡ death was caused by a crescentic fold of the peritonæum, stretched across the upper brim of the pelvis, so as to compress the rectum, which passed down behind, between it and the sacrum.

g. Rostan observed a case where the right ovary was attached to the rectum, with which and the sacrum it formed a sort of sac, in which a piece of the intestine lay strangulated. In an old woman, examined by Gautric,§ the left ovary had contracted adhesions by its external extremity to the lateral surface of the bladder, thus forming a species of arch under which a portion of the ileum, about two feet in length, was engaged and strangulated.

h. The strangulation may be caused by the Fallopian tube. This occurrence is of course exceedingly rare, and the only instance of it on record, so far as I am aware, is that mentioned by Dorilas, in “*Der Beobachtungen für Wundärzte*,” Leipsic, 1783.¶

i. By simple adhesions between one portion of bowel and another, or between a portion of bowel and an adjoining organ. To this division belong those cases of strangulated hernia, in which the stricture, formed by membranous bands, remains after the parts have been replaced into the abdomen.

j. Lastly, it seems probable that a vessel of the mesentery or omentum may prove a cause, on some occasions, of derangement of the functions of the alimentary canal. Monro, in the work before alluded to, mentions a case in which, besides the constriction produced by the omentum, the intestine was surrounded and strangulated by a vessel from the mesentery, not bigger than a small goose-quill.

II. The second species consists of those cases in which the bowel is rotated round its own axis, or round an axis formed by the mesentery. This form of the disease is probably not so infrequent as has been supposed by pathologists. Rokitsansky,¶ in a valuable memoir on internal strangulation, has recorded not less than six examples of it as having come under his own notice; Professor Bigelow, of Harvard University, has also reported a highly interest-

\* *Jurisprud. Medic.*, t. iii., p. 645.

† *L'Examineur Médicale*, Juillet 11, 1841.

‡ *Bulletin de l'Académie Royale de Médecine*, Mars 31, 1841.

§ *Practical remarks on the Discrimination and Appearances of Surgical Disease*, p. 255. London, 1840.

¶ *Voigt*, *Op. cit.*, ii., p. 567.

¶ *British and Foreign Medical Review*, vol. iii., p. 495.

ing case, and another has been recently published by Dr. W. T. Thurston, of New York. The lesion has likewise been observed, it would seem, by Dr. Homans and Dr. J. B. S. Jackson, of Boston.\*

This species of strangulation includes, according to Rokitansky, three varieties of form: first, the rotation of a portion of intestine round its own axis; secondly, round an axis formed by the mesentery; and thirdly, where a portion of bowel constitutes the axis round which another larger portion with its mesentery turns, so as to touch the periphery of the axis at every point. It appears to be the result of the experience of this pathologist, that rotation round the mesentery, as an axis, can happen only to the small intestine; but this opinion is contradicted by the cases of Bigelow, Homans and Jackson, which show that this change may occur also in the large bowel, and in no portion more frequently than in the sigmoid flexure. The rotation of a portion of the alimentary tube round its own axis is most common in the ascending and transverse colon: in the third variety the axis may be formed by any portion of the small intestine, the cæcum, and, perhaps, also, the sigmoid flexure. This species of strangulation occurs almost exclusively in old persons, and its development is favored by the presence of hernial tumors or accidental products, which alter the position and attachments of the abdominal viscera. Rokitansky thinks that it is most frequent in females, but this is probably a mistake.

III. In the third species the narrowing, constriction, or obliteration is produced by the pressure of the mesentery, or of one portion of bowel upon another, the suffering part of the tube being generally interposed between the compressing part and the posterior wall of the abdomen. Rokitansky,† who has met with four cases of this species of strangulation, states that it occurs most frequently in persons considerably advanced in life, and that the tendency to its formation is favored by the great length and laxity of the mesentery, by fecal accumulation in the alimentary canal, by large, old hernia, and by adhesions of the convolutions of the intestines to each other and to the mesentery. The lesion is usually slow in its progress, and is most common in the large bowel, for the obvious reason that this is the more fixed and immovable portion of the tube. I subjoin the following case from Rokitansky in further illustration of the subject. A sugar-baker, forty-eight years of age, died in the General Hospital at Vienna, in 1827. On opening the abdomen, the upper curvature of the sigmoid flexure of the colon was found to be compressed by the mesentery of the small bowel, which lay in the cavity of the pelvis. The mesentery formed in this situation a roundish peduncle, about three inches long, and an inch and a half in thickness, from which the whole convoluted intestine hung. This peduncle, made tense by the weight of the bowel attached to it, lay over the portion of the sigmoid flexure just mentioned, and exhibited at certain points a tendinous appearance. The colon and a portion of the small intestine were considerably distended.

The compression of one portion of bowel by another is rare. One of the most remarkable instances of this kind is that recorded by Gendrin,‡ of a child six months old, who had labored from birth under habitual constipation and vomiting. The arch of the colon was situated between the spine and the duodenum, which confined it like a ligament.

\* See Bigelow's case, *Bost. Med. and Surg. Jour.*, vol. xxviii., p. 438.

† *Brit. and Foreign Medical Rev.*, vol. iii., p. 495.

‡ *Archives de Médecine*, t. viii., p. 494; Andral, *Path. Anat.*, vol. ii., p. 92.

IV. The fourth species is that form of the affection in which the bowel slips into an opening of the mesentery, omentum, or meso-colon. The aperture may be the result of malformation, of external violence, or of interstitial absorption from long-continued pressure. In its diameter it varies from a few lines to several inches, and in its form it is either circular, oval, or slit-like, with sharp and well defined margins. There is seldom more than one such opening, but there may be two or even three. When a portion of intestine insinuates itself into an aperture of this description it either becomes strangulated, or it gradually effects the separation of the contiguous layers of the affected part, and ultimately forms a large bag, capable of lodging the whole of the small intestine. Sir Astley Cooper has published two examples, illustrated by excellent drawings, in which the sacs, occupied by the jejunum and ileum, existed, the one in the mesentery, the other in the meso-colon. An interesting case, in which the colon was strangulated by the meso-colon, was recently published by Dr. Gilman Davis,\* of Portland, in the state of Maine. The patient was a merchant, twenty-six years of age, who died after an illness of three days and a half. A large knuckle of the colon, of a deep purple color, mortified, and thirteen inches in length, was strangulated in a round, well-defined aperture in the meso-colon, about the size of a twenty-five cent piece. The portion of the large bowel between the seat of constriction and the anus measured four feet.

It appears that the intestine may enter the foramen of Winslow, pass into the posterior cavity of the epiploon, and, perforating the transverse meso-colon, there become strangulated. Of this occurrence a case is mentioned by Blandin, in his *Surgical Anatomy*, and another is recorded by Jobert in his "*Traité des Maladies Chirurgicales du Canal Intestinal*."

V. In the fifth place the intestinal canal may be strangulated by the pressure of a tumor, situated either in the abdominal cavity, in the coats of the bowel, or in the interior of the tube. This form of the disease is of very frequent occurrence, is generally of slow formation, and is much more common in the old than in the young or middle-aged.

a. The most frequent cause of this species of strangulation is the existence of organic disease in the coats of the alimentary tube. This is generally of a carcinomatous nature, and the parts more particularly obnoxious to it are the rectum, the sigmoid flexure, the ascending colon, and the ileo-cæcal valve. As the malady progresses, the canal at the seat of the disorganization gradually diminishes in size, until at length the passage of the fecal matter is completely arrested, and the patient dies with all the symptoms of strangulation from ordinary causes.

b. Tumors are sometimes developed within the canal, and these by obstructing the course of the fæces may lead to the same result as disease seated among the tunics of the bowel. A polype of the rectum has been known to produce death by arresting the contents of the tube,† and similar effects occasionally follow the formation of an intestinal concretion.

c. Mr. Howship‡ relates a case in which the strangulation was caused by the pressure of an ovarian tumor upon the rectum, where the latter passes over the brim of the pelvis. The patient was fifty-two years old, and the tumor contained between six and seven pints of serum. The whole of the bowel above the seat of the obstruction was dilated, congested, and filled with fluid matters, as in strangulated hernia.

\* Boston Medical and Surgical Journal, vol. xxx., p. 380.

† Voigtel's Handbuch der Path. Anatomie, B. ii., p. 649.

‡ Op. cit., p. 257.



d. It is not improbable that fatal obstruction of the bowel might be produced by a fibrous tumor of the uterus, or by the uterus itself, when much enlarged and partially dislocated, as in retroversion. Similar effects might result from the presence of a morbid growth of the pelvis and from a distended Fallopian tube.

Dr. Hoescher,\* of Hanover, has published a case of intestinal strangulation produced by hypertrophy of the pancreas. The organ had grown to the size of the head of a four months' fœtus, and had so enclosed the duodenum for about three inches of its length that it would not admit of the passage of a goose-quill.

VI. The sixth species of internal strangulation is produced by what is termed *intussusception*. This consists in the invagination of one portion of bowel within another, thereby filling up its cavity, and usually dragging along with it a portion of the mesentery. To this variety of internal strangulation belongs the very remarkable case recorded by Martin Solon,† in which a coil of intestine was intercepted by getting into a perforation in another coil.

Although generally speaking there is only one invagination, yet there may be as many as three or four. Much diversity obtains respecting the length of the included portion. (Fig. 138.) Most commonly it does not exceed two or three inches; in other cases, however, it may be as much as one or two feet. Dr. Abercrombie makes mention of a case, in which the inverted intestine measured thirty-eight inches; and instances are to be found in which nearly the whole of the large, together with a considerable portion of the small bowel, was thus invaginated, the ileo-cæcal valve descending as low as the anus. Sometimes, though very rarely, there is a double intussusception, one inverted portion of intestine slipping within another.

The included portion of bowel may be variously affected, and give rise to the most terrible results. In children, in whom this lesion is much the most frequent, the invagination is occasionally disentangled, either by the natural energy of the muscular fibres of the intestine, or by the influence exerted upon them by purgative remedies. When the incarceration continues for any length of time, the part usually manifests strong signs of inflammation, and either contracts adhesions to the surrounding gut, or else it dies, and is evacuated. In this way may be discharged large pieces of the alimentary tube, and the patient live for years afterwards, in the enjoyment of perfect health. In the former case, that is, when the bowel remains invaginated, its coats are very apt to become thickened, and lay the foundation of permanent stricture.

The length of the eliminated part is various. In my private collection is a piece of the colon, twenty-nine inches long, which was presented to me by my

Fig. 138.



\* Hannoversche Annalen, Heft ii. 1840; Brit. and Foreign Med. Rev. xii., p. 538.

† Bulletins de la Société Médicale d'Emulation pour 1822.

friend Dr. John Dawson, of Ohio, and passed by a child six years of age, who, notwithstanding, speedily recovered, and is now, five years after the occurrence, in excellent health. In thirty-five cases, collected from different sources by Dr. William Thomson,\* the length of the evacuated pieces varied from six inches to upwards of three feet: they generally involved the entire cylinder of the bowel, and nearly all had a portion of mesentery attached to them. The average duration of the disease was between four and five weeks. In twenty-two of the cases, the eliminated portion appertained to the small bowel, in the other, to the large, or jointly to this and to the former. The cæcum was affected alone only in a single instance, the colon in two, the jejunum in three, the ileum in eleven.

Intussusception may take place in any part of the alimentary canal, but is most common in the ileum, near its insertion into the colon, owing doubtless to the vast difference of size between these two portions. The greater frequency of this lesion in this situation than in any other, was long since insisted on by Dr. Baillie, and the same kind of testimony is borne by almost every succeeding writer. Another fact deserving of notice in this place is, that the invagination does not always occur in the natural direction of the intestine, but sometimes from below upwards; which sufficiently disproves the theory, at one time so much in vogue, that this complaint is always caused by one part of the tube falling within another, simply on account of its weight. Concerning the proximate cause of this disease, very little indeed is known. Nevertheless, it may be conjectured that it is in some way or other connected with inequilibrium of action of the muscular fibres, by which one portion of bowel, contracting energetically, forces itself within another that is stationary, fixed, or passive. If this explanation be not satisfactory, I confess my inability to offer a better. The lesion, it may be here reiterated, is also much more common in infancy than in manhood, — a circumstance affording additional proof in favor of the supposition that has just been advanced, inasmuch as the muscular coat of the intestine, being much more lax and irritable in the young than in the old, is liable to greater irregularity of action.

There is a species of intussusception very different from the one just described, inasmuch as it is entirely unattended by inflammation. I have repeatedly observed it in young children, as well as in adults; and, so far as I can judge, it appears to occur during the last struggles of life, from some irregularity in the peristaltic movements of the muscular fibres. The invagination in this variety of the lesion is always limited, according to my own experience, to the small bowel.

The prominent *symptoms* of internal strangulation are, violent pain in the bowels, generally increased by pressure, urgent vomiting, tumidity and tenderness of the abdomen, and the most obstinate constipation, every endeavor to evacuate the alimentary tube proving unavailing. The pulse is from one hundred and twenty to one hundred and fifty in a minute, small and feeble, and the features have a singularly shrunken and collapsed appearance. The pain in the abdomen, although constant, is aggravated by paroxysms, and is sometimes almost insupportable.

Of the great frequency of this occurrence some idea may be formed when it is stated that, out of three hundred children, opened at the hospital of Le Salpêtrière in Paris, the great majority of them had three or four intussusceptions.† No symptom of inflammation or other disease of the alimentary tube

\* Edinburgh Medical and Surgical Journal, October, 1835.

† Dunglison's Commentaries on Diseases of the Stomach and Bowels of Children. — Amer. Med. Record, vol. viii., p. 139.

attended. The number of invaginations generally varies from two to five or six. In one instance, that of a child, eight years of age, I counted as many as eleven; and Mr. Burns, of Glasgow, on one occasion met with not less than forty-seven. From the fact that this affection usually occurs, either just before death, in the act of dying, or within a few moments after dissolution, before the muscular fibres have parted with their irritability, it may be denominated the *cadaveric* variety of intussusception, in contra-distinction to the other, which is called the inflammatory.

12. *Hernia*. — The subject next in order is *hernia*, of which there are several distinct varieties, both as regards the contents of the tumor and its situation. The most common place of rupture is at the inguinal and crural rings. Cases, however, are often witnessed in which the bowel protrudes at the navel, or some other part of the abdominal wall; and, in a few rare instances, it has been known to pass into the thorax, through an opening in the diaphragm. There is also a species of rupture in which the intestine descends into the scrotum, in consequence of imperfect closure of the inguinal canal. This constitutes what is termed *congenital hernia*. The bowel in this case lies in the vaginal sac, and the manner in which it gets there may be easily explained by referring for a moment to what takes place in the descent of the testicle. Until the end of the seventh month of utero-gestation, this organ is situated in the pelvic cavity, immediately beneath the kidney. About this period it begins to advance towards the abdominal canal, along which it passes, until it finally reaches the scrotum, carrying with it a tubular process of peritonæum. As the descent is being completed, the serous sac here mentioned is gradually obliterated, and the communication between it and the abdomen closed. This usually occurs a few weeks before the child attains to maturity. But it is not always that things thus proceed. In many cases the abdomino-scrotal sac remains open through life, and allows the bowel to pass down in contact with the testicle, forming the variety of hernia in question.

To enter into a minute detail of every thing relating to these different varieties of hernial tumors, would be inconsistent with the scope of the present work; and I shall therefore restrict my remarks rigidly to the morbid appearances which are usually to be witnessed in the protruded parts, referring those who may feel anxious for further information upon this interesting topic to our treatises on surgical anatomy. In the congenital hernia, the mechanism of which has just been described, the intestine generally retains its natural characters, with the surrounding sac scarcely at all altered; and hence, when the patient assumes the recumbent posture, it always has a tendency to glide back into the cavity of the abdomen, descending again when he rises. In chronic cases, however, although the protruded parts themselves may not be particularly affected, the sac, in consequence of the constant pressure that is exerted upon it, is apt to become indurated and thickened, from the deposition of lymph. Shreds of the same substance occasionally adhere to the enclosed bowel, and, by gluing it fast, prevent its return into the abdomen. Similar appearances are sometimes witnessed in the other varieties of long-standing ruptures. In such cases, the sac is often as much as the eighth of an inch in thickness, and evidently consists of a number of well organized layers. The shape of the bag is either oval, rounded, or more usually pyriform, the narrower part being above, the broader below. The neck is sometimes quite long, and so narrow as to allow only a small fold of intestine to pass out at a time. The outer surface of the sac is rough and irregular; the internal smooth, polished, and slightly lubricated by sero-



sity. Such are the ordinary appearances to be observed in old and congenital ruptures.

In recent ruptures, the sac is generally thin and opaque, differing very little from healthy peritonæum. When strangulation occurs, a new state of things supervenes. For not only does the sac evince signs of inflammation, but the protruded part, whether it be the bowel or a portion of omentum, is so excessively irritated that it frequently mortifies, whilst the patient either dies, or is doomed to drag out a wretched existence with an artificial anus. The morbid appearances of strangulation of the bowel are well shown by the subjoined case, which I add so much the more willingly, as it admirably illustrates the obscure character which sometimes attends slight hernial protrusions. The patient was a married woman, forty-five years old, who had labored for several days under obstinate constipation, with slight vomiting, and occasional pain in the epigastric region. Dr. Ridgely, who now saw her, prescribed several doses of active cathartic medicines, and in about twenty-four hours succeeded in procuring a copious alvine evacuation. This, however, afforded only transient relief. The vomiting became more urgent; the abdomen, although neither swollen nor hard, was somewhat tender on pressure; no further discharge could be obtained from the bowels; and she died, gradually exhausted, on the fourth day after sending for her physician. On examination, the cause of these symptoms was found to be a protrusion of a portion of the ileum, scarcely a third of an inch in length, which had got into the internal ring, where it seemed to have been strangulated by a fold of peritonæum, stretched tightly across its upper border. That this was the case, is abundantly proved by the fact, that the stricture still remains in the preparation, although it consists solely of intestine and peritonæum. The portion of bowel between the ring and ileo-cæcal valve was about four feet in length, quite empty and contracted, and without any sign of inflammation. Above this point, the ileum was greatly distended with gas and fecal matter, and bore all the marks of high irritation, the redness, which was of a violet hue, occurring in small patches in different parts of the circumference of the tube. Externally, the bowel was covered with numerous globules of lymph; and the incarcerated part itself was in a state of incipient gangrene, as was shown by its dark color, and by its want of proper tenacity. No shreds of fibrin were to be seen around the margins of the ring; and the stricture was so slight that the strangulated gut was easily withdrawn from its unnatural situation. The colon was sound, but extremely contracted throughout the greater portion of its extent, being scarcely large enough to admit the little finger. The rectum was in the same condition. All the other abdominal organs, as well as those of the thorax, were in a normal state. The peritonæum was natural, excepting immediately around the seat of the stricture, where it was very vascular and inflamed. No external tumor whatever, either before or after death, could be perceived in the inguinal region.

13. *Abnormal pouches*—There is a curious disease of the small intestine, not mentioned, that I know of, in any treatise on pathological anatomy. I allude to those sac-like tumors, cysts, or pouches, which are caused by the protrusion of the mucous and cellular tunics across the muscular fibres, in the same manner as pouches are occasionally formed in the urinary bladder. Cases of this lesion, which appears to be exceedingly rare, have been published by *Monro*,\* *Cruveilhier*,† and *Sir Astley Cooper*.‡ The pouches, situated chiefly along the mesenteric border of the intestine, are of a rounded, spherical, shape, and vary from the

\* *The Morbid Anatomy of the Gullet, Stomach, and Intestines*, p. 178.

† *Anatomie descriptive*, t. ii., p. 492. Paris, 1834.

‡ *The Anatomy and Treatment of Abdominal Hernia*, p. 364. Phila. 1844.

size of a pea to that of a walnut. Some of the larger sacs are occasionally pyriform, or pediculated. Their number ranges from one to several dozens. In a case observed by Cruveilhier as many as fifty existed. Their contents are usually of a gaseous character, since their orifice of communication is rarely large enough to admit of the passage of fecal matter.

I am not certain whether this disease is confined exclusively to the small intestine, or whether it may not also occur in the colon and the rectum. In the case mentioned by Sir Astley Cooper the tumors were situated entirely along the jejunum, and in another, alluded to by Cruveilhier, they were limited to the duodenum. Their development seems to depend upon some mechanical obstacle to the passage of the fecal matter, by which the muscular fibres are separated from each other, so as to permit the mucous and cellular membranes to protrude through the resultant intervals. The accompanying sketch (Fig. 139), affords a good idea of the nature of this affection.



Fig. 139.

14. *Wounds.*—We may next consider the process employed by nature in repairing wounds of the intestinal tube, and the manner in which she disposes of the sutures used in securing their edges.

The first circumstance to be observed in a wound of the bowel is the eversion or protrusion of the mucous membrane (Fig. 140); this takes place in all injuries of this kind, and is similar, in its effects, to the contraction and retraction of the extremities of a divided artery. Its object evidently is to diminish the opening, and thus prevent fecal effusion. These effects are well shown in the following experiments:

1. A longitudinal incision, two lines and a half in length, immediately contracted to one line and three-quarters, with a sufficient amount of eversion of the mucous lining to close the resultant orifice. 2. A similar wound, four lines long, diminished in a few seconds to three lines, by one line and a half in width; it assumed an oval shape, and the internal membrane protruded on a level with the peritonæal covering, leaving no perceptible aperture. 3. An oblique cut, seven lines in length, contracted to five, by two and a half in width, with marked eversion of the mucous lining. 4. A transverse wound, two lines and a half long, was reduced almost instantaneously to two lines in diameter: it was of a rounded form, and the two outer tunics of the gut retracted so as to expose the mucous membrane. 5. In another experiment, in which the incision, likewise transverse, was half an inch in extent, the orifice assumed a rounded, oval shape, and was reduced to four lines, by two and a half in width, the internal coat exhibiting, as in the other cases, a pouting, or everted arrangement.

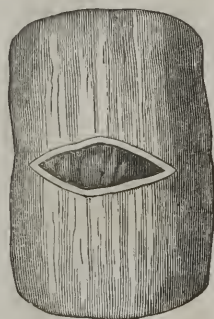


Fig. 140.

This eversion of the mucous membrane never occurs in ulcerative perforation of the bowel. In this affection the morbid action generally proceeds in a slow and gradual manner, at the expense mainly of the mucous and fibrous lamellæ, which are always destroyed to a much larger extent than either the muscular or peritonæal. Hence, by the time the ulcer reaches the surface, it is impossible for the lining membrane to protrude across it, as it does when the bowel is wounded by a sharp instrument, a blow, or a kick. Another circumstance which no doubt contributes to produce this result, is the indurated condition of the serous and muscular layers immediately around the perforation, caused by the deposition of lymph during the progress of the ulcerative action.

There is thus a striking difference, as respects their immediate effects, between an opening of the bowel from ulceration and one produced by an incised or lacerated wound. In the former, although it may not be two lines in diameter, extravasation would be almost certain; in the latter, it might be nearly double that size, and yet, for the reason just mentioned, that event, so much to be dreaded, would be little likely to occur.

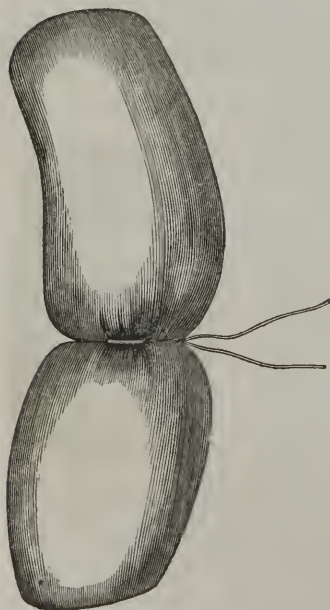
From numerous experiments on dogs, the results of which are detailed elsewhere,\* I have been led to conclude that wounds six lines long, whether transverse, oblique, or longitudinal, are almost always, if not invariably, followed by the escape of fecal matter, and the consequent development of fatal peritonitis. If, on the other hand, the breach is only four lines in length, no matter what may be its direction, extravasation will be comparatively rare, nature, properly aided by art, being usually fully competent to effect reparation.

If a small circular ligature be drawn firmly round the bowel of a dog, or

other animal, the resulting effects will be very similar to those which attend the ligation of an artery. The opposite surfaces will not only be forced into close contact with each other, but it will produce at the same time a complete division of the mucous coat. If the cord be pulled very tightly, there will be in addition, especially in young subjects, a partial separation of the cellulo-fibrous lamella and of the muscular fibres. These effects I have repeatedly witnessed in my experiments on dogs, and they may be readily produced in the human body after death. If a flat ligature be used, even when it is drawn with considerable firmness, the opposite surfaces of the tube are merely brought into contact, without any rupture of the substance of any of the tunics. The only exception to this is where the animal is very young and the parietes of the bowel are unusually tender; in which case there will be occasionally a slight division of the lining membrane, but not of the muscular fibres. When a narrow ligature is used, the parts above and below it are so closely approximated that they touch in the greater

portion of their circumference; a circumstance which must necessarily exert a

Fig. 141.



\* See my "Experimental and Critical Inquiry into the Nature and Treatment of Wounds of the Intestines." Louisville, 1843.



most favorable influence over the reparative process and the re-establishment of the continuity of the canal.

Soon after an operation of this kind, in which a narrow circular ligature is used, inflammation is set up, plastic lymph is deposited upon and around the constricted parts, ulcerative absorption is established, and the cord at length works its way into the intestinal tube, where it is discharged along with the feces. The period required for the detachment of the ligature may be supposed to be influenced by various circumstances, the principal of which are referable to the form and size of the foreign substance, together with the force with which it is applied, the thickness of the different tunics of the bowel, the age of the subject, and the state of the general health at the time of the operation, as well as immediately after it. In a small but full grown dog, killed at the end of the third day after the experiment, the ligature, which was round and narrow, had found its way through more than one-half of the circumference of the tube, and in another animal of the same kind, which died from the effects of the operation thirteen hours later, the progress of the foreign body was still greater. In the latter, indeed, the cord had entirely disappeared, having lost its hold, and escaped into the bowel, in which, after a minute examination, it was discovered at the distance of several feet from the seat of the injury, surrounded by fecal matter. In both cases the continuity of the parts was thoroughly re-established by an abundant deposition of lymph, which, notwithstanding the brief period that had elapsed, exhibited already well-marked traces of organization. The bowel, however, presented in each instance a constricted appearance; and in one of the animals, that, namely, which was killed at the end of the third day, the opposed mucous surfaces were still in close contact, no attempt having apparently been made to restore that portion of the tube. In the other the parts were not only perfectly continuous with each other, as has just been intimated, but the cavity was partially re-established. In a third experiment, performed on a middle-sized dog, not more than eighteen months old, the ligature was found lying at the seat of the constriction, where it was retained by a layer of plastic lymph, which had sealed up, as it were, the surface of the fissure in the mucous tunic. The canal of the bowel was completely restored, and the bond of connexion between the divided parts firm and organized. The animal was killed on the

Fig. 142.

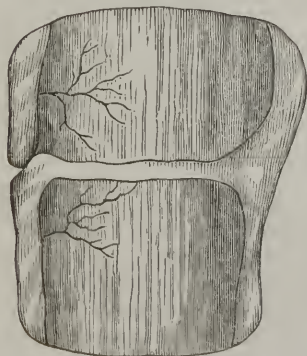
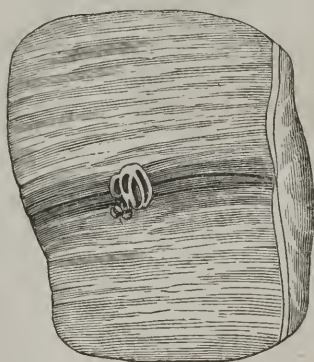


Fig. 143.



eleventh day. These appearances are exhibited in the subjoined wood cuts. Fig. 142 is the outer surface of the tube; Fig. 143, the internal.

The following experiment was performed by Mr. Travers, and is recorded in his work on wounds of the intestines. A ligature of thin pack-thread was firmly tied around the duodenum of a dog, so as completely to obstruct it. The ends of the string were cut off, and the part returned. On the fifteenth day, his cure being established, he was killed. A portion of omentum connected to the duodenum was lying within the wound, and the folds contiguous to the strictured intestine adhered to it at several points. A slight circumferential depression was observed in the duodenum, and the mucous surface was more vascular, as well as of a deeper color, than usual. A transverse fissure marked the seat of the ligature. The edges of the sections were distinctly everted, and the appearance corresponded with that of the union by suture.

The lymph which is effused upon the external surface of the bowel, consequent upon the operation, gives the part at first a rough uneven appearance; but after a few weeks, sooner or later, according to circumstances, it undergoes a sort of modelling process, and hence, if the animal survive several months, it is generally no easy matter to determine the seat of the injury. In a dog which was killed four months after the experiment was performed, the reparation was so perfect that, had it not been for the attachment of a small process of omentum, it would have been impossible, by mere external inspection, to discover the place where the cord was originally applied, such were its smoothness and polish. Nor was this confined solely to the outer surface of the tube. Internally the cicatrization was almost as complete, the continuity of the mucous membrane having been every where re-established. There was scarcely even a seam at the original seat of the constriction. (Figs. 144, 145.)

Fig. 144.

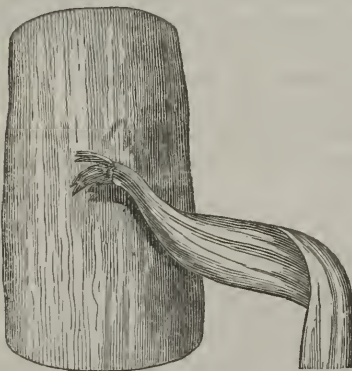
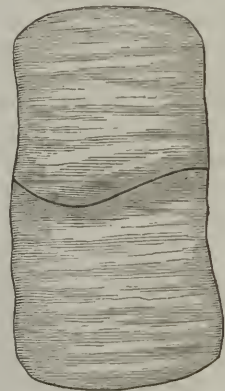


Fig. 145.



Effects similar to the above are produced when a ligature is applied round the edges of a small wound, that is to say, from two to three lines in diameter, provided it be drawn with sufficient firmness not to slip off. The cord gradually cuts through the different coats of the bowel, and the continuity of the canal is re-established by the effusion of plastic lymph upon the constricted part. The process of reparation, however, is not so speedily completed, owing to the breach being much wider than when a ligature is simply cast round the tube. In this case the mucous membrane is reproduced only after a long time, and the amount of lymph required is proportionally much greater. The ligature is detached at a period varying from five to ten days.

Wounds and punctures of the bowel, unaccompanied by the effusion of fecal matter, heal, when left to themselves, either by the adhesion of their edges to the surrounding parts, or by the deposition of lymph upon their surface and the gradual approximation of their lips. In the majority of cases the reparation is probably effected by the former method; since there is always a great tendency in the wounded structures to attach themselves to those in their immediate vicinity. Even wounds of large size are occasionally repaired in this manner. In some instances, again, the breach is closed by a piece of omentum, which projects into it, and fills it up like a tampon. When this happens the serous membrane is firmly fixed to the edges of the opening, and the part which corresponds with the interior of the canal and assists in maintaining its continuity, is eventually absorbed; an occurrence which leads to the gradual approximation of the lips of the wound and their ultimate reunion. Jobert thinks that this mode of reparation is not uncommon, an opinion in which my observations do not induce me to concur.

In mortification of the bowels, especially when occurring in small patches, the mode of reparation appears to be similar to that which takes place when a wound or puncture is left to itself. By the time the eschar is detached the edges of the breach will have formed adhesions to the circumjacent parts, by which the effusion of fecal matter will be effectually guarded against. Where this is prevented the patient dies from peritonæal inflammation, or an artificial anus is established.

The subject of gunshot wounds of the intestines appears to have been more profoundly investigated by Baron Larrey than by any other surgeon. He divides the curative process into four stages. In the first, the bruised and lacerated tissues are deprived of their vitality, to an extent varying according to the amount of the injury they have sustained. In this respect a gunshot wound of the alimentary canal does not differ from that of any other part of the body. In the second stage, the eschar is detached, and the opening gives vent to feculent and purulent matter, which continues to escape for several weeks or even months. During the third stage, the discharge gradually diminishes, and at last ceases altogether to appear externally. The union of the wound constitutes the fourth stage. The corresponding textures gradually approach each other, and, cicatrizing from within outwards, the whole chasm is at length completely filled up: the primitive adhesions become absorbed, and there only remains a slight contraction of the intestinal tube at the wounded part.\*

When sutures are employed, the mode of reparation is essentially alike, whatever may be their form. The inflammation which is lighted up induces an effusion of lymph, which is speedily followed by adhesion of the injured coil to the neighboring structures, among which it is sometimes completely buried. At other times no such adhesion occurs, but the affected part throughout the entire line of suture is coated with a layer of plastic matter, by which the continuity of the serous surface is finally re-established, and the threads used in sewing up the wound are concealed from view. In almost all cases—certainly in eight out of ten—there is an attachment of the omentum to the surface and edges of the wound, which thus assists, in an eminent degree, in the process of restoration. (See Fig. 144.)

This extraordinary tendency to adhesion in the external surface and edges of the wound to the parts around it, is nothing more than what might be expected when we reflect upon the nature of the peritonæum, and its invariable

\* *Medico-Chirurg. Review*, vol. xvi., p. 58.



disposition, when inflamed, to pour out lymph. But it is otherwise with the mucous membrane. Here the process of re-union is not only much slower but much less perfect; lymph is furnished very sparingly, or in quantities barely sufficient to fill the chasm between the margins of the wound; and, owing to the heterogeneous and irritating nature of the contents of the tube, a long time must necessarily elapse before it can become an organized or living intermedium. The little narrow band thus formed adheres firmly to the bottom of the wound, but very slightly, if at all, for some days, to its edges. Gradually, however, it becomes more and more dense; vessels extend into it from the circumjacent parts; its margins are flattened down; and, after a period varying from a few weeks to as many months, the adhesion is finally completed. Subsequently, or, indeed, while the changes just adverted to are still in progress, the new matter is nearly all absorbed, the wound greatly diminishes in width, and when the cicatrizing process is perfected merely a small depression or seam remains, to indicate the original seat of the injury. The whole process may be compared to that which nature employs in the reparation of ulcers of the mucous lining of the small and large bowel. (See Figs. 146, 147.)

Fig. 146.

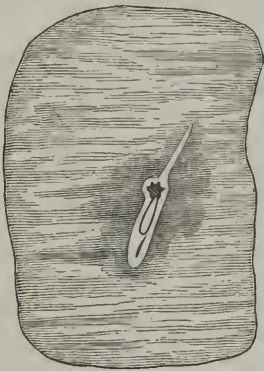
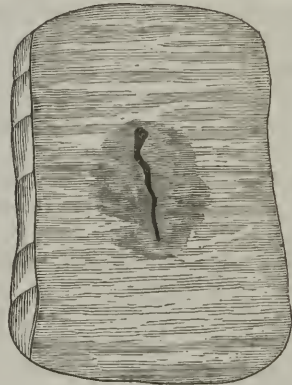


Fig. 147.



This, however, is only one mode in which the restoration of the mucous surface is effected. Another, though by no means a frequent one, is by granulation. It has been already stated that, owing to the irritating and heterogeneous character of the contents of the bowel, the lymph which is deposited upon the wound is very tardy in becoming organized, and it may now be added that this process is occasionally entirely prevented, the substance in question being either destroyed or removed by the fecal matter, as it passes over the affected part. When this happens, nature makes an effort to repair the breach by the formation of granulations, as in similar injuries of other textures. The process under these circumstances is generally much more tardy than in the previous case, the cicatrization is also less complete, and the tube is much more apt to be puckered immediately around the seat of the injury. Mr. Travers seems to doubt that the fissure in the mucous lining is ever filled by granulation. "I had been led to expect," says he, "that the interstices of the villous coat would be filled by granulation, and that the substance of the cylinder would in this way be restored at the place of division. But finding the eversion of the villous edges uniform and permanent, it seemed doubtful if such a process could be set up, as perfect surfaces were opposed

to each other. It is also not inconsistent with the indisposition of mucous surface to the adhesive inflammation to infer that it does not readily admit of the granulating process, which is only an advanced stage of that inflammation."\* I quote the language of this distinguished author, in order that his meaning may be fully understood. I am not aware that a similar opinion has been expressed by any other writer, and how so accurate an observer should have arrived at so erroneous a conclusion cannot be easily conceived. That granulations are formed on mucous surfaces is a matter of daily observation, and my researches have abundantly satisfied me that they are occasionally concerned in the restoration of the villous portion of a wounded bowel. The process of course is difficult; it must be so from the very nature of the mucous tissue, indisposed as it is to pour out plastic lymph; but this does not prove that it may not take place.

This writer has made another remark, not less erroneous, in relation to this subject, when he asserts that the adhesion which takes place between the mucous surfaces within a few hours after their connexion by suture is in no instance permanent, but that it is destroyed by the retraction of the divided parts when the ligatures drop off. Such an occurrence does undoubtedly sometimes take place, but I have repeatedly observed the reverse, and there is reason to believe, judging from the results of my own researches, that this happens much more frequently than is commonly supposed. Several days, often as many as eight or ten, must of necessity elapse before the sutures are detached; a period which is more than sufficient, in the plurality of cases, for the agglutination of the villous lips of the wound by plastic lymph. The apposition of the parts, moreover, is eminently favored by the crippled and paralysed condition of the muscular fibres at the seat of the injury, and by the tendency of the mucous membrane to eversion at the moment of the accident.

From the foregoing observations it is evident that the process of re-union is the same, whether the bowel be encircled partially or wholly by a ligature, whether we employ the suture, or, lastly, whether the wound, provided it be not too ample, be entirely intrusted to the resources of nature. In each case the restoration is effected through the medium of plastic lymph, poured out as a consequence of inflammation, and undergoing, sooner or later, a certain degree of organization.

The manner in which the ligatures are detached varies, as might be expected, according to the mode in which they are applied. Both in the interrupted and continued sutures, with their different modifications, the threads, provided their extremities are cut off close to the surface of the wound, invariably fall into the alimentary canal, along with the contents of which they are afterwards evacuated. This, indeed, may be laid down as an axiom, to which I saw no exceptions in any of my experiments, and which fully confirm, in this particular, as well as in many others, the researches of Smith, Thomson, Travers, and Cooper.

The same circumstance, as was previously intimated, occurs when a ligature is cast around a loop of intestine, or when it is employed to encircle the margins of a small aperture, whether caused by injury or mortification. If, on the other hand, the extremities are permitted to hang out at the external wound, they will be discharged outwardly instead of inwardly, as in the former case.

15. *Artificial Anus.* — Artificial, accidental, or preternatural anus may occur in any part of the abdomen; but, as it is generally produced by gangrene of the bowel, from the pressure which is exerted upon it by hernial stricture, it is

\* Op. cit., p. 131.

by far most frequently met with in the inguinal, scrotal, femoral, and umbilical regions, particularly the first two. For the same reason we find that the small intestine is much oftener involved than the large, which is fixed or attached, while the former is loose, floating, and consequently more liable to protrusion. Occasionally, though rarely, the abnormal anus has its seat in the lumbar region, high up in the iliac, the hypochondriac, or even the epigastric.

Three causes mainly give rise to this affection, namely, strangulated hernia, accompanied with mortification of the bowel, penetrating wounds, and stercoraceous abscess; the frequency of their occurrence being in the order in which they are here enumerated. A blow or kick on the abdomen may so contuse, bruise, or injure the bowel as to lead to the establishment of an artificial anus. Jobert\* saw a case in which an opening was formed in this way between the ileum and the vagina, and examples of a similar kind have been witnessed by others.

When the bowel is extensively divided by a sharp instrument, and the wound is managed improperly, or left to itself, the patient either perishes from peritonæal inflammation caused by fecal effusion; or adhesions take place between the gut and the adjacent parts, and the contents of the tube issue at the external orifice. The latter always happens when this accident is treated in conformity with the method of Palfin, Bell, and Scarpa, who advise the inner wound to be kept in apposition with the outer, by a ligature passed through the mesentery.

Stercoraceous abscesses are induced by various causes; sometimes by ulcerative action, often by external violence, and occasionally by the irritation created by the presence of a foreign body, as a needle or pin, a fish or chicken bone, or a piece of coin. In either case, as soon as the matter is discharged, whether spontaneously or by the efforts of the surgeon, the feces escape at the abnormal aperture, either wholly or in part, and the patient is affected, not merely as some have pretended, with an intestinal fistula, but with a genuine preternatural anus. Large fecal accumulations have sometimes been mistaken for this kind of abscess; the knife or lancet has been plunged into them, and the disease in question has been the consequence, or the individual has died from peritonæal inflammation. Artificial anus is occasionally congenital, in which case it is usually seated at the umbilicus.

Mortification, like penetrating wounds, may affect the entire circumference of the bowel, or only a part of it. The extent of the lesion will exert a material influence upon the restorative process, and in this respect the disease might not inappropriately be divided into partial and complete.

The external orifice of an artificial anus exhibits no uniformity in respect to its size and configuration. In many cases it is rounded, in some ovoidal, and in most irregular. In its diameter it varies from a few lines to an inch and a half or even two inches; being usually smaller in traumatic cases, or in such as result from penetrating wounds, than in those which are produced by ulceration, abscess, and especially by gangrene. The margins of the opening are thick, bevelled, depressed, or inclined towards the centre, where they are in close contact with the mucous membrane of the two ends of the bowel, the junction between them being indicated by a reddish line; they have a raw, flesh-colored appearance, and are covered with numerous granulations, which are often very painful, and so irritable as to bleed upon the slightest touch. The matter which they secrete, and which is seldom very abundant, does not differ from that of other sores under similar circumstances. In cases of long

\* *Maladies du Canal Intestinal*, t. ii, p. 95.



standing, or where the fecal discharges are unusually acrid, the edges are very much indurated, inflamed, highly sensitive, and studded with fungous vegetations, some of them the size of a split pea, or even half a dime. In a third series of cases, perhaps, they are elevated, hard, and almost insensible. The skin in the immediate vicinity of the opening, as well as for some distance beyond it, is red, inflamed, chapped, fissured, excoriated, or ulcerated, and so tender frequently that the patient cannot bear to have it touched, wiped, or washed, however gently this may be done.

The depth of the outer orifice, or the distance between the skin and the bottom of the intestinal aperture, varies from three to twelve lines. It is always less when the disease is produced by a wound than when it is caused by gangrene; much will also depend upon the natural thickness of the wall of the abdomen, and the degree of plumpness or emaciation of the individual. Lallemand met with an instance where the distance between the two points was nearly two inches, and in another, which fell under the observation of Delpech,\* it was upwards of three inches.

The external orifice is occasionally multiple, that is, instead of a single opening there are several. In this case there are usually fistulous tracks, which communicate with the main outlet, and sometimes even with each other. Velpeau mentions an instance in which there were not less than five or six distinct apertures, and another, not less remarkable, is related by Dupuytren.† This perforated and cribriform state of the parts is generally produced by some of the stercoraceous matter insinuating itself among the muscular fibres and cellular substance of the abdomen before the margins of the external orifice are sufficiently protected by the new adhesions. An abscess soon forms, preceded by an erysipelatous blush of the skin, and followed by a discharge of purulent matter, almost insupportably fetid in its character.

The union between the two ends of the bowel and the circumference of the outer orifice is effected through the medium of plastic matter, and constitutes an indispensable element of the disease. The inflammation, preceding and accompanying the effusion, always begins in the serous surfaces of the parts, from which it gradually extends to the other structures, as the mucous membrane, the muscles, cellular substance, and the skin. The plastic matter, soft and glutinous at first, is soon organized, and thus opposes an effectual barrier to the effusion of fecal matter into the abdominal cavity. Subsequently it undergoes all the changes that lymph experiences, under favorable circumstances, in other situations. The extent of this adhesion varies, in different cases, from half a line to a line; it rarely amounts to half an inch, or, indeed, even the fourth of an inch, and in proportion as it is firm or otherwise will it be able effectually to resist the influence of such causes as have a tendency to separate the gut from the wall of the abdomen. Dupuytren met with two cases in which the union was so feeble that the intestine lost its hold, and the patients died from fecal effusion.

When the artificial anus supervenes upon strangulated hernia, the formation of these adhesions usually precedes the death of the bowel; in the traumatic variety of the affection, on the contrary, they are established after the reception of the injury, and hence the greater frequency of fatal effusion in the latter than in the former. As the adhesions extend only a small distance along the gut, a cul-de-sac is formed, the opening of which looks towards the belly, and into which the abdominal viscera may protrude, so as to complicate the disease.

Immediately around the inner margins of the outer orifice are, as was pre-

\* *Dict. de Médecine*, t. iii., p. 347.

† *Ibid.*, p. 346.

viously stated, the two ends of the bowel; lying generally side by side, like the tubes of a double-barrelled gun. Each opens by a distinct orifice, of which the upper, in time, becomes much the larger; they are bounded by a sort of villous rim, are irregularly rounded in their form, and are separated from each other by a septum or partition. The upper orifice gives passage to the fæces, and, as it is unprovided with a sphincter muscle, the patient has no control whatever over their escape. Even mechanical means will not always obviate this inconvenience, and the utmost attention to cleanliness does not defend the surrounding parts from the effects of the acrid discharges. The lower orifice of the same size at first as the upper, is generally very narrow, puckered up, and sometimes even difficult to be found, especially when it has ceased for a long while to receive fecal matter. The upper opening is temporarily closed when the corresponding extremity of the bowel is touched with a probe or finger, or exposed to a few drops of cold water. When thus irritated it presents very much the appearance of the anus of the horse, the mucous lining being everted and corrugated by the peristaltic action of the muscular fibres.

The two ends of the bowel, at first similar in size, by degrees undergo important changes. The upper continually giving vent to feculent matter, bile, mucus, and even ingesta, receives a preternatural quantity of blood, and hence generally acquires a considerable increase of volume and strength; its coats are thicker than in the normal state, the muciparous follicles are larger, the lining membrane is of a deeper red, and the peristaltic action is inordinately energetic. The lower extremity, on the contrary, having no longer any active function to perform, falls into a state of atrophy. Its tunics are pale, flaccid, and attenuated, its caliber is considerably diminished, though not obliterated, and its mucous glands are wasted and almost imperceptible. The canal contains a soft, whitish, gelatinous looking substance, which is evidently the product of an imperfect secretion, and which is voided by stool at intervals of two, three, or four months. The intestine, notwithstanding these alterations, still preserves its tubular form, however long the fæces may have been discharged through the abnormal aperture. That this is the fact has been proved by repeated dissections. Thus, Lecat examined the body of a female who had labored under this malady for twelve years, and in whom the inferior portion of the gut, or the part comprised between the natural and artificial outlet, was still pervious, though much contracted. Similar observations have been made by Desault and Dupuytren. The latter opened a patient, two years after the establishment of an artificial anus, and found that the tube not only remained pervious, but that it had experienced comparatively little diminution. The following case, however, observed by Mons. Begin,\* of Paris, shows that the obliteration of the intestine, although extremely rare, is not impossible. The patient was eighty years of age when he died, and for more than half this period he had labored under an artificial anus, seated in the left groin, and communicating with the arch of the colon. The superior extremity of the bowel only opened at the external orifice, and gave passage to the fecal matter. No aperture, corresponding with the other end, could be discovered either in the cicatrice or in the surrounding parts. The gut itself was converted into a hard, solid, whitish cord, not thicker than a common quill, which passed to the left kidney, from which it descended, after several turns, to the anus, increasing somewhat in size as it approached its termination. The inferior part was still pervious, and contained a little whitish mucus; the upper for the length of six or eight inches, next to the abnormal aperture, was completely

\* *Dict. de Med. Chir. Pratiques*, t. iii., p. 133.

obliterated; and the intermediate portion was so contracted as scarcely to admit a small probe.

This atrophy or wasting is not confined to the lower portion of the bowel, but often affects the corresponding part of the mesentery and even the lymphatic ganglions. As might be supposed, it is always more marked in old than in recent cases.

In artificial anus, caused by a gangrened rupture, the two ends of the bowel are surrounded and closely embraced by a sort of membranous pouch, to which Scarpa, who first described it, has applied the name of *infundibulum* or *funnel*.\* It is formed by the prolongation of the peritonæum which constituted the neck of the hernial sac, and varies very much in its shape, dimensions, and direction, its base being at the bowel, and the apex at the skin. It is generally very firm and dense in its structure, and from one to two lines in thickness, according to the extent of the previous inflammation; externally it is intimately united to the margins of the abnormal opening, and internally it presents a smooth villous surface, not unlike that of an old fistulous track. The feculent matter from the upper orifice is poured into this cavity, and thence, when the artificial anus is closed, it is carried, after describing a half-circle, into the lower end of the canal. This membranous pouch is always wanting when the disease is the effect of a penetrating wound, and occasionally even when it is the consequence of a gangrened hernia: in both cases the gut adheres immediately to the edges of the opening in the muscles and integuments. The most interesting circumstance connected with this funnel-shaped cavity is the influence which it exerts upon the reparative process, or spontaneous cure, which is always so much the more prompt and perfect in proportion as it is larger and longer.

Interposed between the two extremities of the intestine, and formed by the

Fig. 148.



a a. Opening of the artificial anus, and point of union between the skin and the mucous membrane; b, upper end of the intestine; c, lower end of the intestine; d, the septum or peron, or ridge, formed by the walls of the two contiguous cylinders; e e, parietes of the bowel; f, the ligament or cord formed by the mesentery; g, the cul de-sac between the peritonæum of the intestines and of the abdominal walls, into which herniæ occasionally protrude.

juxta-position of their sides, is the *ridge*, *septum*, or *partition*, which Scarpa has described under the name of the promontory, and Dupuytren under that of the

\* Treatise on Hernia, Memoir Fourth, p. 288.



épéron, spur, or buttress. (Fig. 148.) It consists of two angular or crescentic folds composed each of four lamellæ, of which the inner two are of a serous nature, and firmly united together by plastic matter, for an extent varying from one to six, eight, or even twelve lines. The outer layers are of a mucous character, and are continuous with the lining membrane of the tube, of which they form a part. Dividing the bottom of the funnel, where it is situated, into two unequal parts, this septum juts out nearer to the surface of the abnormal opening in proportion as the loss of intestinal substance has been more considerable, and the change in the direction of the tube more marked. It is small, and scarcely perceptible, when the gut has been merely pierced by a wound, or slightly affected by an eschar, but large and prominent, when the lesion, whatever it may be, involves the whole circumference of the canal.\* In the former case, the two orifices of the bowel are separated by a kind of gutter or groove, which directs the transit of the fecal matter from the one to the other, and greatly facilitates the attempts at cure; in the latter, the septum forms a projecting angle or buttress, which conducts the contents of the upper orifice towards the abnormal outlet, and which nothing but art can break down or surmount.

When the two lamellæ of which this septum is composed are viewed posteriorly, or from within the belly, we find that they gradually recede from each other, leaving thus a triangular interval between them, the apex of which corresponds to the point of separation, and the base with the abdominal cavity. The surfaces of these lateral layers, which are, in fact, nothing but the parietes of the affected cylinders of the bowel, are invested by a reflection of the peritonæum, and afford attachment to a process of the mesentery. From the manner in which this membrane is stretched between the spinal column and the concave side of the intestinal convolutions, it follows that it is always more or less dragged on when the gut is protruded from the belly, forming a sort of cord by which the body is inclined forwards, and the tube drawn inwards. A constant traction is thus kept up, which varies in degree in different cases, and which has occasionally been sufficient to destroy the adhesions between the bowel and the wall of the abdomen, causing fatal effusion into the cavity of the peritonæum.†

The matter which issues at the abnormal opening varies in its properties according to the length of time it is retained in the bowel, the nature of the food, and the state of the patient's health. Generally speaking it is soft, semi-fluid, or even quite liquid, of a greenish color, and composed of an admixture of fæces, bile, and intestinal secretion, together with ingesta. Its consistence is always less when the artificial anus involves the jejunum or the superior extremity of the ileum than when it affects the lower portion of the small bowel, the cæcum, or the colon. In the former case, too, it has less stercoraceous odor, and occasionally contains a considerable quantity of pancreatic juice. The frequency with which it is voided is materially influenced by the nature and quality of the food, as well as by the manner in which it is prepared, and by the distance which intervenes between the abnormal aperture and the stomach. When the artificial anus is situated near this organ, it commonly passes off within an hour or two after eating, whereas, if it be lower down it may not be voided for five or six hours, or perhaps not oftener than three or four times a day. The evacuations, as was before intimated, are always involuntary, and are generally effected with considerable rapidity, being accompanied with a

\* Dupuytren, *Dict. de Méd. et Chir. Pratiques*, t. iii. p. 130.

† Dupuytren, *Leçons Orales*, t. iii., p. 207. — *London Medico-Chir. Review*, vol. ix., p. 315.

peristaltic movement of the upper extremity of the gut and a sort of rumbling noise, especially when there is an escape of air.

The quantity of fecal matter flowing along the abnormal opening, like its quality and the frequency of its discharge, must necessarily be influenced by a variety of circumstances. Of these the most important are the amount of food, the extent of the intestinal lesion, and the size of the septum between the two ends of the bowel. Most persons laboring under this disease eat voraciously, often, indeed, three or four times as much as they did before; they are always hungry, have an enormous appetite, and are never satisfied. This is particularly the case when the ingesta are retained only for a short time. Hence there is a proportionably large accumulation of feculent matter, and as this cannot pass from one intestinal orifice into the other, in consequence of the mechanical obstacle interposed between them, most of it, if not all, escapes at the abdominal opening.

The pernicious influence which the brief sojourn of the alimentary matter exerts upon the system is not always so great as might be supposed. Indeed, not a few instances are related in which the patients not only retained their health and strength, but even grew fat. In the generality of cases, however, the effects are quite the reverse. The food is retained too short a period to be properly acted upon by the digestive organs; the function of chylification is impaired; nutrition is carried on imperfectly; the body is emaciated, and there is a proportionable failure of the physical powers. In extreme cases, that is, where the general health is otherwise affected, or where the passage of the aliment is exceedingly rapid, the patient has sometimes perished from inanition.

Another very serious inconvenience to which persons laboring under artificial anus are subject is the protrusion of the extremities of the gut. This often amounts to a real prolapsus, and is liable to occur, no matter what may have been the cause of the disease. It may affect one or both ends, but the upper is more frequently involved than the lower, though the reverse is said to be the case by Boyer, not, however, with any foundation in truth. The extent of the prolapsus varies, in different cases, from three to eight inches; more rarely it amounts to a foot, or even a foot and a half. In its diameter the tumor seldom exceeds two and a half or three inches. It is more or less conical in its shape, contracted at the base, and perforated at the extremity by an irregularly rounded opening. The everted mucous membrane is at first only preternaturally red and vascular; by degrees, however, it becomes thickened, rugose, indurated, and completely hypertrophied. In this respect it experiences the same changes of structure as the villous coat of the rectum in prolapsus of the anus. The swelling, which is commonly much larger in the erect than in the recumbent posture, frequently possesses so little sensibility that it may be touched or handled without pain. At times, however, it is excessively tender, and may then become a source of real suffering, depending more, perhaps, upon the state of the system than upon that of the part immediately concerned. Strangulation of the prolapsed intestine occasionally occurs.

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## SECTION VII.

### OF THE DISEASES OF THE LARGE BOWEL AND ANUS.

*Ulcers* of the large bowel very much resemble those of the small, except,

perhaps, that they are more frequently of a linear shape. This, at least, is the form in which I have hitherto more particularly met with them. When beginning in the mucous follicles, they are more apt to be rounded: in this case, too, their edges are often remarkably ragged, thin, and undermined, a circumstance which gives them the appearance of being much larger at the base than at the top. In such instances, moreover, the glands are sometimes entirely removed, or portions of them are left in the midst of the ulcerated surface, in a state of induration. Occasionally nearly the whole of the large bowel is thus affected; but the sections most frequently diseased are the cæcum and ascending colon, together with the right half of the transverse arch, whilst the rectum and the remainder of the gut are comparatively seldom implicated. In ninety-two cases of intestinal ulceration, reported by Andral, only one occurred in the rectum.

The size of these ulcers is sometimes very considerable. I have repeatedly seen them of the diameter of an American dollar, and, on several occasions, between three and four inches in length by one and a half in breadth. When of these dimensions, the abrasions are generally formed by the agglomeration of a number of smaller ones. In the linear varieties, I have, in a few instances, found the ulcers extending almost completely around the circumference of the bowel, constituting narrow grooves, of variable depths, with rough, elevated, and indurated edges. As in the rest of the alimentary tube, the ulcerative process may successively invade the different tunics, and finally lead to perforation; in which case the contents of the gut may be effused into the peritonæal sac, or else find their way into the surrounding hollow viscera. A fistulous opening sometimes forms through the walls of the abdomen, in the right iliac fossa, or in the groin just above Poupart's ligament.

In the first edition of this work I expressed the belief that ulcers of the large bowel were less liable to cicatrize than those of the small; an opinion which, from what I have since witnessed, I find no reason to change. I could not at that time, notwithstanding the numerous dissections in which I had been engaged, recall to mind a solitary instance of *complete* reparation in this portion of the alimentary tube. Within the last few years, however, several well-marked examples of this kind have fallen under my observation, and I have preserved two or three specimens in my museum which fully illustrate this interesting subject. Still, as before intimated, I have witnessed this phenomenon much less seldom, comparatively speaking, in the large than in the small intestine. The reason I cannot explain. The circumstance may be wholly accidental; more probably, however, it is owing to the more solid and heterogeneous nature of the contents of this division of the alimentary canal, whereby the reparative process is more easily disturbed, if not often completely prevented.

Nature may sometimes be detected, as it were, in the very act of reparation. Thus, in the ascending colon of a married woman, thirty-three years of age, who died, gradually exhausted, after an illness of nine weeks, I found the mucous membrane very much thickened, and of a dark red color, with a deep linear ulcer two inches and a half in length by three lines in width, the surface of which was covered with small masses of plastic lymph, so firmly adherent that it was difficult to scrape them away. In this case, it is obvious, there was an attempt at cicatrization; and, had the patient lived long enough, it would, no doubt have gone on to completion. In another instance, that of a man twenty-two years old, who died of chronic diarrhœa, a small circular ulcer existed in the sigmoid flexure, the centre of which was coated with a thick layer of lymph, which had evidently been deposited only a short time previously to death.



The *vermiform appendage*, although in its structure closely resembling the rest of the intestinal canal, may, nevertheless, be considered as a distinct organ, possessing peculiar anatomical relations, and executing functions different from those of the rest of the alimentary canal. It is about three inches in length by three lines in diameter, slightly convoluted, and often considerably larger at some points than at others. Its coats are as thick as those of the cæcum, and composed precisely of the same anatomical elements. No little variety exists in relation to the size and situation of this tubular diverticulum. Whilst occasionally it is very diminutive, I have seen it, at other times, nearly half a foot long, and fully as large as the little finger, without any apparent disease. The appendage is occasionally deficient, even when the rest of the bowel is perfectly normal; and not unfrequently it deviates remarkably from its accustomed position. In inflammation of the peritonæum it is often firmly glued to the neighboring organs, as the uterus and urinary bladder; and, under such circumstances, it has been known to produce strangulation of the small bowel.

The usual contents of the vermiform appendage are of a mucous nature, and of a soft, semi-fluid consistence. Fæcal matter rarely finds its way into it; when it does, it is very apt to become impacted, and to produce mischief. Not a few cases are recorded where the most violent inflammation was thus induced, followed by gangrene of the tube and general peritonitis. But the most common cause of disease, undoubtedly, is the ingress of some foreign body, such as a bean, a cherry-stone, or biliary concretion, producing local irritation, which rapidly spreads from the mucous to the other tunics. Severe peritonitis is soon lighted up, lymph is poured out, and the appendage speedily falls into a state of mortification. In another series of cases, the disease assumes a milder character, the serous membrane is comparatively little affected, there is scarcely any albuminous exudation, and the inflammation finally passes into suppuration; or adhesions are formed between the cæcal appendage and the adjacent parts, and the extraneous body, exciting ulceration, at length escapes to some other situation.

Dr. John Burne, physician to the Westminster Hospital, has published, in the twenty-second volume of the *Medico-Chirurgical Transactions of London*, an excellent Memoir on Inflammation and Perforative Ulceration of the Cæcum and Vermiform Appendage, in which he gives an analysis of twenty-one cases occurring under his own observation. He describes the affection under the name of *Tuphlo-Enteritis*. Two of his patients were under ten years of age; seven between ten and twenty; three between twenty and thirty; six between thirty and fifty; three between fifty and seventy. Six were gentlemen; one was a coachman; one a farrier; five were boys without any particular occupation; three were destitute; and five were females. Thirteen recovered; eight died. In nineteen, the disease was acute; in two, chronic. In fourteen cases it was seated in the cæcum; in seven in the vermiform appendage. Of the latter six died, one of acute inflammation, with circumscribed peritonitis, and five of ulcerative perforation; the duration of the affection varying from sixty hours to four weeks. Of the former all recovered save two, who died of chronic disease.

Dr. Burne states that he has noticed *tuphlo-enteritis* most frequently in the autumn and beginning of winter; a circumstance which coincides with the experience of Dupuytren,\* who has published an analysis of sixteen cases which he observed in Paris. The French author thinks that the disease is most common before the age of thirty, as eleven of his cases occurred before

\* *Leçons Orales*, t. iii., p. 337.

that period ; that men are more liable to it than women ; and that certain occupations, as painting, color-grinding, and turning in copper, predispose to its development. This latter supposition is probably fallacious ; at all events, it is strikingly at variance with the facts observed by Dr. Burne.

Inflammation originating in the vermiform appendage is ordinarily characterized by bold and well-marked symptoms. "Very acute pain, tumefaction, and tenderness are complained of upon the invasion of this form of the disease ; first in the right iliac region, and subsequently more or less over the abdomen, with excruciating tormina, obstinate constipation of the bowels, a very frequent, small, or contracted pulse, heat of skin, dry tongue, great thirst, sometimes with numbness of the right leg, or pain shooting down the thigh, and retraction of the testicle."\* Vomiting at length sets in, with or without relaxation of the bowels, the patient manifests great restlessness, the countenance assumes a sunken aspect, and death generally takes place from the third to the sixth day, preceded, observes Dr. Copland, by the symptoms ushering in dissolution from intestinal peritonitis. In a letter lately received from Dr. J. B. S. Jackson, of Boston, he informs me that he has seen four dissections, besides two recent specimens of gangrene and perforation of the vermiform appendage, in which the symptoms corresponded sufficiently well with the description of the distinguished pathologist just quoted.

The more insidious form of this disease is well illustrated by the following case, communicated by my friend, Dr. Richards, of Cincinnati, who had the kindness to send me the diseased bowel. The patient, a gentleman, thirty-five years of age, had enjoyed good health up to the 24th of August, 1837, when he was attacked with bilious fever. His tongue at this time was considerably coated ; there was headache, with pain in the back and limbs ; the skin was hot and dry ; the pulse ninety in a minute ; and there was, moreover, a slight hacking cough, which, however, had been present, at intervals, for the last ten months. Under an active course of treatment, these symptoms gradually disappeared, and, by the fifth of September, just a fortnight from the invasion of the disease, the patient was to all appearance convalescent ; the pulse being slow and soft, the tongue clean, and the appetite quite good. On the evening of the same day, however, after partaking pretty freely of indigestible food, he was suddenly seized with severe pain in the abdomen, accompanied with slight distention of the hypogastric region, and great tenderness on pressure : the pulse became feeble, and beat one hundred and forty strokes in a minute ; the surface was cold, and bathed with profuse perspiration ; and there was considerable embarrassment of breathing. These symptoms gradually increased in severity until the seventh of September, about forty-two hours from their first manifestation, when the man expired, in a state of complete collapse. On dissection, the following appearances were noticed : the omentum, with nearly the whole peritonæum, was in a highly inflamed condition ; the bowels were distended with gas, and extensively agglutinated by coagulating lymph ; the pelvis was filled with fecal matter ; and there was a large, ragged ulcer in the vermiform appendage, which had perforated all the coats. Through this ulcer the fecal matter had escaped, inducing violent and fatal peritonitis. The mucous membrane of the stomach was highly inflamed, and incrustated with patches of lymph, but that of the intestines was perfectly healthy, except immediately around the seat of the disease.†

\* Copland's Dictionary of Medicines, article *Cæcum*.

† Those who are anxious to obtain further information on this subject, will do well to consult Dr. Copland's Dictionary of Medicine — a work which should be in the library of every intelligent physician — and Dr. John Burne's Memoir on Typhlo-Enteritis, or Inflammation and Perforative Ulceration of the Cæcum and Appendix Vermiformis, in volume xx. and xxii. of the London Medical-Chirurgical Transactions.

*Hypertrophy* of the coats of the colon is rare, but by no means infrequent in those of the rectum, where it is occasionally conjoined with permanent stricture. The gut, for some distance above the narrowing, is usually considerably dilated, either with or without attenuation of its tunics, or the reverse. The extent to which the hypertrophy occurs, varies from a few inches to several feet; and, in a few instances, I have seen it involve the whole of the large bowel: the coats which are more particularly affected are, the mucous and cellulo-fibrous, the latter of which, especially, is frequently six or eight times the normal thickness: the muscular fibres are also apt to become very much altered, both as respects their size and color; but the serous texture rarely participates in the morbid derangement. When the hypertrophy is of long standing, the bowel almost always acquires an extraordinary degree of density, offering as much resistance to the knife as fibro-cartilage, and emitting the same creaking sound.

Tubercular, melanotic, and cancerous affections are rarely found in the large bowel. When carcinoma occurs, it usually has its seat in the ileo-cæcal valve, or in some portion or other of the rectum; and, as it may be said to be almost peculiar to the latter, we shall postpone, for the present, the consideration of it.

Both the colon and the rectum are occasionally the seat of *wart-like excrescences*, similar, in many respects, to those which we so often see on the female organs of generation. Of this lesion I have seen several well-marked examples. In a specimen (Fig. 149) preserved in my private collection the mucous membrane of nearly the whole of the large intestine is thickly studded with these vegetations, the smallest of which are scarcely as big as a pin-head, whilst the largest are from three to eight lines in length, by two lines and a half in diameter. The former, which are infinitely the most numerous, are, for the most part, of a spherical shape: the latter, on the contrary, have an elongated, conical appearance, not unlike the nipples of some of the inferior animals. A few of the larger ones are bifid, and several adhere by a narrow peduncle, their free extremity being much broader than the attached. These singular excrescences are most abundant in the rectum and the sigmoid flexure of the colon, from which they gradually decrease in number, though not in volume, as they approach the cæcum, where they are entirely wanting. Their surface is somewhat rough, as if covered with villi, and in the recent state they were all of a dark mulberry hue. The parietes of the bowel are very much thickened and indurated, especially in the inferior three-fourths of its extent; and the caliber of the tube is diminished to less than one-half the normal size, and of the rectum to less than one-third. The subject of this disease was a man about sixty years of age, during the last four of which he was constantly harassed with diarrhœa and intestinal pains, which produced excessive emaciation and gradual exhaustion.

Fig. 149.



In another specimen of a similar nature, which was kindly presented to me by the late Dr. Herron, of Cincinnati — a gentleman who died too soon for the



cause of the science to which he was so ardently attached, and of which he bid fair to be one of the brightest ornaments — the walls of the colon are also very much thickened, though not so much as in the preceding case, and the inner surface, besides being cellulated, like a honey-comb, is covered with an immense number of soft, fungoid excrescences, some of which are nearly half an inch in length. In their shape they exhibit almost every variety, some being conical, some spherical, and some angular. Many of them arise by a common base, and, jutting out like little slender arches, unite, at the top, leaving thus a number of intervening spaces which readily admit of the passage of a large sized probe.

The structure of these vegetations seems to be very analogous to, if not identical with, that of the natural mucous membrane, upon which they grow, and of which they may, therefore, be regarded merely as so many prolongations. That this is the case is sufficiently obvious when we make a section of them. In both the specimens, in my possession, the inner surface of the colon and rectum presents thousands of hypertrophied villi, and similar bodies are plainly visible, even to the unassisted eye, on the warty excrescences. Thus, then, it may be concluded, that these singular growths are neither villousities in a state of preternatural enlargement, nor new formations, but simply, as we have just intimated, so many prolongations of the mucous corion, folded over a small quantity of cellular substance. Their vascularity is sometimes very great, and there is reason to believe that they are susceptible of a sort of erection.

How these vegetations originate is still a mooted question. That chronic irritation has some agency in their production cannot, I think, be denied, as we seldom if ever meet an instance in which the bowels have not been seriously and for a long time deranged; but what the peculiar modification is, and why these bodies should exist in some cases and not in others, are problems which must, for the present, remain undetermined. In the individual, a young courtesan, twenty-three years of age, from whom Dr. Herron obtained the interesting specimen which he presented to me, there had been well-marked signs of chronic colonitis for several years, with occasional intervals of perfect health. She finally died of gangrenous inflammation of the vulva and vagina, having for the last few months suffered severely from disease of the bowels, the principal symptom of which was torturing pain in the umbilical region, with frequent slimy and bloody evacuations. So also in the other case I have mentioned, chronic inflammation had invaded nearly the whole of the large bowel, and had existed for nearly four years, having been engrafted upon a severe attack of Asiatic cholera.

The following case, for which I am indebted to Dr. Abercrombie, conveys a very good idea of the symptoms and modifications of disease of the mucous membrane of the large bowel. A lady, thirty-five years of age, was suddenly seized with vomiting and purging, which continued, with occasional intermissions, until the ninth day of the attack, when she expired, in a state of perfect exhaustion. Sometimes there were not more than three or four alvine evacuations in the twenty-four hours; and she occasionally passed a whole night without any disturbance; yet, however this might be, the countenance had always an expression of great anxiety and feverishness. There was but little pain in the bowels, and, after the first three days, scarcely any tenderness on pressure of the abdomen. The evacuations were in general copious, thin, and of a feculent appearance. Towards the last, they became extremely fetid, streaked with blood, dark-colored and puriform.

On examination, the mucous membrane of the cæcum was found to be of a uniform deep red color, and covered by numerous well-defined ulcers, some of them the size of a sixpence. In the ascending colon, there was a more

irregular state of disease, consisting of slight scattered erosions, variegated with dark fungoid elevations. In the arch of the colon, the lesion assumed a still different character. Here the ulcers, scarcely as large as a split pea, were quite distinct from each other, with the intervening structures perfectly sound. In the descending colon, the whole of the mucous membrane exhibited one continued surface of disease. It was of a dark brown color, fungoid and spongy, without any defined erosion, and throughout very much thickened. The other tunics along this portion were also considerably hypertrophied, and in some places almost of cartilaginous hardness. This state of disease extended from near the commencement of the descending colon to within two inches of the extremity of the rectum, where it abruptly terminated. The stomach and small intestines were quite healthy, excepting the inferior portion of the ileum, which was very vascular and inflamed. The peritonæal covering of the large bowel, especially about the sigmoid flexure and the upper part of the rectum, was of a dark red color, and dotted with small specks of lymph.

It deserves to be remarked here, that, about four years before, this patient had an attack of disease very similar to that of which she died, and that during the whole of this interval she occasionally complained of uneasiness in her bowels. Up to the day of the last attack, however, she was apparently in perfect health, and able to take a great deal of exercise. The bowels were habitually costive, and required the frequent use of gentle laxatives.

In leaving this subject, there is one point upon which I deem it necessary to make a few comments. I allude to the singular contraction of the large bowel which is so frequently met with in our post-mortem examinations. Every physician who is in the habit of making researches of this kind must have frequently observed this appearance. During the early period of my professional life, before I had much acquaintance with morbid structure, I was inclined to look upon this contraction as the effect of disease; and as such, there is reason to believe, it is still regarded by many at the present moment. That this, however, is not the fact in the great majority of instances, my own experience decidedly tells me; and, in order to avoid all mistake upon the subject, I would suggest that, whenever this appearance is witnessed — as it will, I feel confident, in nine cases out of every ten — the bowel should be carefully opened with the scissors, and thoroughly scrutinized, with a view of ascertaining the color, consistence, and thickness of its several tunics; for by such a procedure alone can the investigator arrive at any satisfactory conclusion.

The parts of the large bowel most subject to this contraction are the left half of the arch of the colon, the descending portion, the sigmoid flexure, and the upper half of the rectum, — the frequency of its occurrence being in the order here enumerated. All these parts are often narrowed at the same time, and occasionally to such a degree that the caliber of the tube is nearly obliterated. What this condition is owing to it is difficult to conjecture; nor am I able to offer any opinion upon the subject, excepting that these parts of the alimentary tube, being less liable, during the last stages of our existence, to be distended by fecal matter, the muscular fibres are enabled to contract with more energy than in the rest of its extent.

There are some organic lesions which are either peculiar to the rectum and the anus, or which occur so frequently in these situations, as to render it proper that a short account of them should be presented in this place. Of these affections, the most important, from the frequency with which they demand surgical interference, are carcinoma, stricture, ulceration, and vascular excrescences.

*Carcinoma* may exist as a primary affection, or be propagated from the sur-

rounding organs, particularly the uterus and vagina. Its most common seat is from two and a half to three inches above the inferior outlet of the bowel, though occasionally it is much lower down, as well as higher up. In a case recently under my observation, the disease involved both the margin of the anus and the lower portion of the rectum, which latter it encircled in the form of a dense, resisting ring, about four lines high, and more distinctly marked behind than in front, with a central opening large enough to admit the middle finger. The anus was exceedingly diminished in size by two scirrhus tubercles, one about the volume of an almond, the other of a pullet's egg. The latter was ulcerated upon its inner surface, and both were the seat of sharp, lancinating pains. The patient was a young man thirty years of age, and the disease was first noticed seven months before he came under my care.

This affection presents itself either as a distinct tumor, or as an infiltration in the submucous cellular tissue, from which it gradually extends to the other tunics. Its anatomical characters are the same as those of carcinoma of the stomach and œsophagus; that is, it is either of a hard, dense, gristly, consistence, with a rough, nodulated, and ulcerated surface; or it is of a soft and pulpy texture, like the medullary substance of the brain; or soft and gelatinous, like the matter of colloid. In fact, cases sometimes occur in which these heterologous deposits are intermixed, or where they form different and distinct portions of the morbid mass. The mucous and muscular coats of the bowel are usually very much thickened, and the former is often thrown into large, irregular ridges, in the intervals of which it is not uncommon to find small fissures, chaps, or erosions. The fleshy fibres are at first very little changed, but as the disease progresses they lose their reddish color and soft consistence, and are transformed into pale, gristly bands, possessing all the properties of the new deposit, whether scirrhus, enecephaloid, or colloid. When the affection is of long standing, the hemorrhoidal vessels are always much enlarged — sometimes quite varicose — and the surrounding cellular tissue is matted into a condensed mass, destitute, in great measure, of its primitive characters.

When this disease affects the rectum, it usually terminates abruptly both above and below, but as it progresses its boundaries assume a more irregular form, and processes often extend in different directions. The degree of constriction varies from the slightest possible change of the natural caliber of the tube down to the size of a goose-quill. The bowel immediately above the seat of the disease is generally somewhat dilated, either uniformly, or, as is more commonly the case, at one or more points. Inferiorly, on the other hand, it is usually contracted; at times nearly obliterated.

The height to which the disease extends varies in different cases from one to three inches. Mr. Mayo has usually found it occupying from four to five inches, and in one instance he saw it reach as high as sixteen. Bégîn\* has known it to be prolonged to the arch of the colon, transforming all the descending portion of that intestine into a scirrhus tube, the walls of which were from three to four inches in thickness, and its caliber almost entirely obliterated, while the inferior three inches of the rectum had not experienced the slightest change of structure. There is reason to believe that the disease generally, if not always, begins in the mucous follicles, from which it spreads with more or less rapidity to the other tissues.

Carcinoma of the rectum and anus, like the same disease in other parts of the body, is most frequently observed in adult and advanced life, though in-

\* Dict. de Méd. et de Chir. Pratiqu., t. iv., p. 570.



stances of it occasionally occur at a much earlier period. Mr. Mayo has observed ulcerated scirrhus in a subject twelve years old, and encephaloid has been repeatedly noticed before the age of puberty. My own observations, which, however, are very limited, go to show that cancer in these situations is more common in men than in women, but whether this is really the case admits of doubt. The experience of Mr. Mayo and Mr. Copland would seem to prove that it is more frequent in the female sex.

No perplexity can prevail in the recognition of cancer of the rectum and anus. The leaden and sallow complexion; the deep-seated, lancinating pains, darting through the hips and pelvis into the groins, and down the thighs; the difficulty of evacuating the bowels; the frequent discharges of bloody, purulent mucus; and the presence of a tumor in some portion or other of the tube; are signs which unerringly stamp the nature of this formidable malady.

There is a singular species of ulceration of the rectum, which has attracted much attention in France, but which, I believe, is extremely rare in the United States, and in many districts of Europe. I refer to the lesion which was first described by the late Professor Boyer, of Paris, under the name of *fissure* of the anus. The disease, as just intimated, consists in an elongated, narrow ulceration, which commonly arises immediately above the internal sphincter, on the posterior surface of the gut, opposite the point of the coccyx, in consequence, frequently, of some mechanical cause. The bottom of the fissure is usually formed by the submucous cellular tissue, and has a soft, spongy feel, but the edges are indurated and more or less prominent. The peculiar character of this disease is, that it is invariably attended by spasmodic contraction of the sphincter muscles of the anus; owing to which the patient generally experiences the most horrible torture on every attempt at defecation. Occasionally considerable hemorrhage takes place from an ulcer of this kind.

There is a species of *spreading* ulcer of the mucous membrane, which is said to be extremely prevalent amongst the females of Great Britain.\* The disease is characterized by the complete removal of a considerable portion of the lining membrane of the rectum, with a dense, indurated, and almost gristly state of the muscular tunic. It usually commences about half an inch within the anus, and terminates above by a rather abrupt but very irregular line of demarcation. The ulceration frequently extends around the whole bowel, and sometimes high up into the sigmoid flexure of the colon. Unless taken in hand early, it is very apt to prove intractable.

The symptoms of this disease are, pain and soreness in the rectum, difficulty in passing the fæces, and a sense of weight in the pelvis, with irritability of the bladder and bearing down of the womb. The pain which is always much aggravated by the action of the diseased bowel, frequently shoots down the thighs, and the patient has no ease except in the recumbent posture.

The pouches which naturally exist within the cavity of the rectum, between the external and internal sphincter muscles, are liable to enlargement, in consequence of the lodgement of fecal matter, and probably also from other causes. The dilatation may affect only one sac, or several may be involved simultaneously, or successively. In degree it varies from the slightest increase of the normal dimensions to the development of a cavity, half an inch or more in diameter. The sac never extends above the margin of the internal sphincter, but it may descend so low as to project beyond the level of the verge of the anus, in the form of a soft, elastic tumor, as big as an olive. Its lining membrane may be natural, thickened, or attenuated, and usually fur-

\* Mayo, *Outlines of Pathology*, p. 318.

nishes an abundant glairy mucus. The disease is slow in its progress; and one of the earliest symptoms complained of is an extraordinary itching or sense of weight at the anus, to which is subsequently added violent smarting pain during every attempt at defecation.

*Organic stricture of the rectum* (Fig. 150)\* consists in a thickened, indurated condition of the mucous and cellular textures, by which the caliber of the tube is more or less contracted. A smooth gristly ring is thus formed, from a few lines to half an inch in depth, above and below which the bowel commonly retains its natural structure. The thickening does not, however, always embrace the entire circumference of the rectum; not unfrequently, indeed, it forms a mere segment of a circle, and is so arranged as to give the villous tunic in the immediate neighborhood a remarkably puckered appearance. When the ring is complete, it strongly resembles a scirrhus pylorus. Hypertrophy of the muscular tunic is also occasionally observed, but the peritonæal is seldom implicated.

Fig. 150.



The common seat of organic stricture is about three inches above the anal orifice. Cases, however, are frequently observed, in which it is much lower down or higher up. The disease spares neither age nor sex. Whilst it is not unusual about the meridian of life, it has been repeatedly witnessed in children as early as the eighth year, and in the old as late as the eightieth.

The nature of this lesion can only be satisfactorily determined by an examination with the finger, and by a careful investigation of its history. The same difficulty is experienced here in relieving the bowel as in carcinoma of the rectum and fissure of the anus; but what perhaps serves, in some degree, to distinguish this affection from any other, is the peculiar shape of the fæces, which, instead of being voided in thick masses, come away in short, narrow pieces, often not larger than a full-sized catheter. The bladder is sometimes excessively irritable, from the pressure of the loaded gut; and occasionally one or more fistulæ form in the nates or the perinæum. In the female, a communication frequently takes place between the rectum and the vagina; and in the male a similar passage may be established, though more rarely, between the rectum and the bladder.

Authors have noticed a *spasmodic stricture* of the rectum, caused by an irregular contraction of the muscular fibres. It is supposed to be most common in the upper portion of the tube, and to be dependent upon a vitiated state of the secretions.†

*Polypes* of the rectum, although very infrequent, have not received the attention they deserve. They may occur at any period of life, but are by far most common in children under ten years of age. Occasionally they are observed soon after birth, and hence it has been inferred, and not without reason, that they may exist as a congenital vice. Almost always single, there are sometimes as many as three, four, five, or even half a dozen. Their ordinary

\* This and several of the succeeding figures are copied from the work of the late Dr. Bushe, of New York, on the Diseases of the Rectum.

† Mayo, op. cit., p. 350.

situation is from one to two inches above the anus. When there are several such tumors they usually occupy different portions of the circumference of the gut, and the highest may be entirely beyond the reach of the finger. In their shape they may be globular, ovoidal, pear-like, or vermiform; and in their size they vary from that of a cherry to that of a hickory-nut, a hen's egg, or even a small fist. They are of a soft spongy consistence, and of a pale-rose color, bright red, purple, whitish, or of a dirty drab.

Fig. 151.

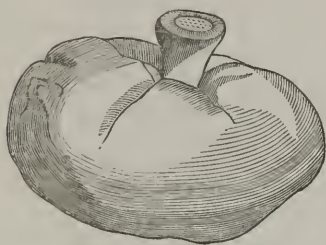
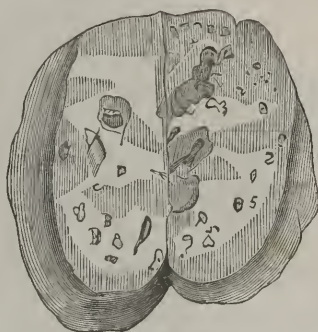


Fig. 152.



Composed of a cellulo-fibrous, fibrous, or gelatinoid texture, the foreign body is invested by a prolongation of the mucous membrane of the bowel, and is usually attached by a short, narrow pedicle, though occasionally it adheres by a tolerably broad base. Its surface, which is generally smooth and regular, is sometimes remarkably rough, knobby, mammillated, or lobulated, giving the part the appearance of consisting of several distinct masses. In a preparation presented to me by Dr. Hardin, of Greensburg, Kentucky, the tumor has a singularly porous appearance, very much like that of a sponge. The openings, which exist in immense numbers, freely communicate with each other, and vary in size from the smallest pin-head to that of a pea. The largest, as I have ascertained by a careful inspection, were filled with a white inspissated mucus, which was easily pressed out with the finger, and the removal of which was followed by a considerable diminution of the tumor, originally about the volume of a hen's egg, and of an oblong reniform figure. It was of a bright red color before removal, bled freely at every point of its surface when touched or irritated, and was suspended by a rounded pedicle two inches long by four lines in diameter. This pedicle took its rise a little above the sphincter muscle on the right side of the rectum, communicated to the finger a pulsation as strong as that of the radial artery, and was inserted into the centre of the tumor very much as the stem is into an apple. The subject, a boy ten years old, had labored under the disease six years. The form and structure of the tumor are exhibited in Figs. 151 and 152.

Owing to the constant contact of fecal matter, polypes of the rectum are liable to inflame and ulcerate, or even to assume a malignant tendency. When very vascular, they are apt to bleed freely, especially when they are roughly handled or irritated. Gerdy\* refers to a polypous tumor of the rectum, which was ulcerated, and presented a cavity containing indurated fecal matter and small calculi like grains of wheat. The mucous coat immediately around the

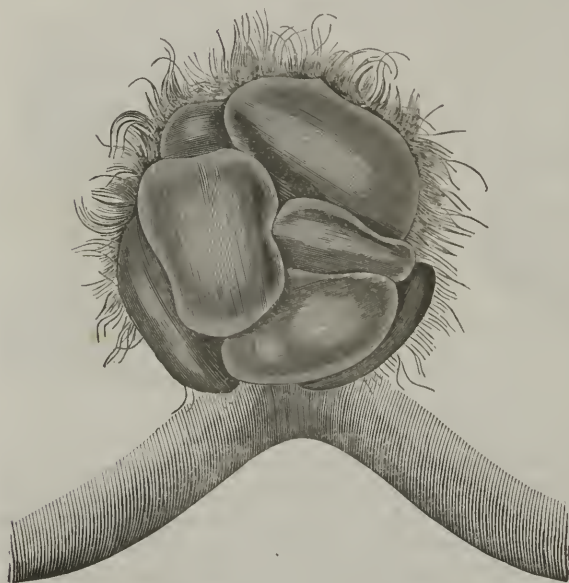
\* Des Polypes et de leur Traitement, p. 179. Paris, 1833.



foreign body may be perfectly natural, or it may be thickened and changed in color.

*Hemorrhoids* may be distinguished into two varieties, one of which essentially consists in a varicose and erectile condition of the vessels, the other in

Fig. 153.



the formation of a small sac filled with blood. In the latter case, the disease presents itself in the form of one or more rounded, or ovoidal lumps, seated at the verge of the anus, or just within the external sphincter. In their size, they vary between a cherry and an almond (Fig. 153); they are of a soft, spongy consistence, and their color is either lilac, red, or livid, according to their age and the degree of pressure exerted upon them by the surrounding parts. When of old standing, they often appear like hard, indurated knobs, quite pale, and almost devoid of

sensibility. The manner in which these tumors are produced is easily explained. In straining at stool, or in riding on horseback, a hemorrhoidal vein gives way, and blood is extravasated into the connecting cellular tissue, where it forms a circumscribed swelling, covered partly by skin, partly by mucous membrane. The blood at first is perfectly fluid, but in a short time it coagulates, and subsequently undergoes the same changes as in apoplexy of the brain.

Fig. 154.



These circumstances satisfactorily account for the difference of color and consistence between a recent and an old hemorrhoidal tumor, as well as for the great facility which the blood can be pressed out of the sac in the one case, and the great firmness with which it adheres to its walls in the other.

The blood which is effused in this variety of the disease may be entirely absorbed; but more commonly it remains, and is gradually converted into a tough fibrinous substance, of a pale reddish or greyish color. Vessels extend into it from the parts by which it is covered, and in this manner it becomes at length inseparably united with the inner surface of the sac. These tumors are generally the cause of the pale,

flabby, and corrugated excrescences (Fig. 154), so frequently noticed at the verge of the anus, and the interior of which is occasionally of a hard fibrous

consistence, similar to indurated cellular tissue. This appearance is well exhibited in the accompanying cut. (Fig. 154.)

This variety of hemorrhoidal tumor differs remarkably from the one next to be described in that it never bleeds, and in being of a lighter color. It is most frequent after the age of twenty-five or thirty; but in a few instances I have met with it in very young children, without any assignable cause. It is exceedingly common in females, during the latter months of utero-gestation.

The second form of hemorrhoidal tumor is produced by the dilatation of the capillary vessels of the mucous membrane, just above the internal sphincter muscle. (Fig. 155.) The disease is generally slow in its progress, and often exists for a considerable period before it is detected. Certain occupations predispose to its occurrence, and it seems to be more frequent in the male than in the female. It seldom appears before the twenty-fifth year, and is most common after the age of forty.

Fig. 155.



The tumors in this variety of the affection are of a soft, spongy consistence, erectile, and remarkably prone to hemorrhage, the blood often spirting from them in a full stream. In their color, they vary from a light red to a deep purple; their volume may equal that of a pea, a filbert, or an almond; and their number seldom exceeds three or four. In several cases, however, I have counted as many as six or eight. They are usually isolated, but now and then they are grouped, so as to form a mass an inch or two in diameter. They may involve the entire circumference of the gut, or be confined to particular parts of it. Their surface is frequently incrustated with coagulating lymph, and the mucous membrane over them is liable to give way from the most trifling causes, followed by more or less hemorrhage. Sometimes the blood oozes out at numerous points, by a process of exhalation. The bleeding, however induced, may amount to several ounces a day, and if long continued, is sure to be attended by an anæmiac condition of the system, with partial or complete prolapsion of the mucous membrane. To this form of the disease the term *bleeding* or *internal piles* is usually applied.

A tumor, very different in its character from the true hemorrhoidal, is sometimes met with at the verge of the anus, principally as the result of severe straining at stool, or of rough horseback exercise. It consists of an effusion of serum in the submucous cellular tissue, in the form of a rounded, or ovoidal elevation, from the volume of a cherry to that of a small hickory-nut; it is of a pale yellowish color, or nearly perfectly white, almost transparent, glossy, and very much like the vesicle of a common blister. It pits slightly under the finger, and generally attains its full size in ten or fifteen hours. A few delicate straggling vessels, the color of which beautifully contrasts with that of the other parts, may often be seen ramifying over its walls, or intersecting its substance. The tumor, although sometimes multiple, is almost always solitary. The disease is strictly analogous to œdema of the vulva and the glottis.

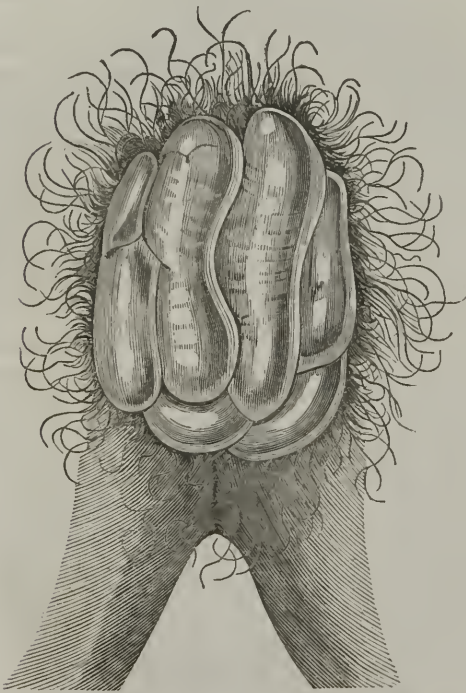
The *warty excrescences*, so frequently observed at the verge of the anus, may be the remains, as already stated, of shrunken hemorrhoids, or they may be formed by a dense, thickened, and hypertrophied condition of the common integuments and submucous cellular tissue. In the latter case, the tumors are external from their earliest development, which is caused either by continued friction, by habitual straining, or by want of cleanliness. They are of a flattened, oblong shape, mammillated, irregularly rounded, or conical, dense and firm in their consistence, indolent, or insensible, and of the same color pretty

much as the skin, except when they are inflamed or highly congested, when they are red or purple, and extremely painful. Their number is variable, but there are seldom more than three or four. Excrescences of this description may attain the volume of an almond or a small fig. They never bleed, but they may ulcerate, and become the seat of a purulent or thin sanious discharge. When very old they are generally of a hard, fibrous, or fibro-cartilaginous structure, from the effects of interstitial changes.

The veins of the rectum, like those of the abdomen, the spermatic cord, and lower extremity, are liable to *varicose enlargement*. This state may exist alone, or in association with hemorrhoidal formations. The dilatation may affect a single trunk, or a considerable number, either simultaneously, or successively; and may extend as high up as the commencement of the sigmoid flexure of the colon. The veins are knotty, convoluted, thinner in some places than at others, and four or five times the natural size. Occasionally they are hard and firm, or soft and friable. The surrounding parts are thickened and œdematous. The cause of this affection is purely mechanical, and consists in whatever has a tendency to interfere with the passage of the venous blood. The distended veins sometimes burst, and thus give rise to more or less hemorrhage.

*Prolapsion* of the anus is another disease which requires brief notice in this

Fig. 156.



place. Of this there are two forms. In the first (Fig. 156), which may be termed the partial prolapsion, the mucous membrane of the lower bowel alone is everted, so as to present the appearance of a ring: it is usually observed in the vigor of life, and very frequently depends upon the presence of hemorrhoids. In the second variety (Fig. 157), there is a descent of all the coats, the whole or the greater portion of the rectum falling through the external sphincter muscle. The extent to which the protrusion occurs varies from a few lines to six or ten inches. In cases of the latter kind, it is probable that there is a real invagination of the sigmoid flexure of the colon; for it is difficult to conceive, as has been justly remarked by Professor Syme,\* of Edinburgh, how the rectum could suffer the requisite dis-

placement, even supposing that it possessed the necessary length. When the prolapsion is complete, as in the form of the lesion we are contemplating, the tumor is commonly of an irregularly globular figure, and varies from the size of an egg to that of the two fists, the mucous membrane is of a dark livid color, from the constriction of the capillary vessels, and affords a thin,

\* Principles of Surgery, p. 294. Edinburgh, 1837.



bloody secretion, which has been compared, not unaptly, to red currant jelly. If the parts be allowed to remain long in this situation, the effect is that they not only become very much thickened, but they gradually assume a fibro-cartilaginous consistence. Protrusion of all the tunics occurs chiefly in children and aged persons, particularly in females of relaxed frame.

Fig. 157.



A *fistula* is a small narrow passage, which has one of its openings in the neighborhood of the anus, the other in the rectum: in some instances, the upper extremity of the tube terminate blindly as a cul-de-sac. Its length varies from a few lines to several inches; its diameter generally equals that of a common probe, and occasionally that of a goose-quill. A channel of this kind is either straight or crooked; and when several coexist, they not unfrequently communicate with each other. Internally, it is lined by a layer of adventitious membrane, the surface of which, usually somewhat rugose, is constantly bathed with purulent matter, either alone, or mixed with fæces. A fistula is always preceded by an abscess, and may therefore be considered as a consequence of its imperfect restoration.

The number of external openings varies in different individuals. Generally there is but one; but sometimes two, three, or even more exist. In a preparation in my possession (Fig. 158), there are as many as seven; and in a case mentioned by Professor Gibson,\* of Philadelphia, there were not fewer than fifteen. When the number of apertures is very great, the integuments have a cribriform or sieve-like aspect, the subjacent cellular substance is extensively destroyed, the surface is of a marbled or pale

Fig. 158.



\* Institutes of Surgery, vol. ii., p. 141.

livid color, and there is a constant discharge of thin, sanious, and offensive fluid. This form of fistula is most frequently observed in phthisical subjects and habitual drunkards. When there are but one or two orifices, the surrounding parts are generally very callous, more or less red, and studded with fungous granulations, especially in cases of long standing. In regard to their shape, the external openings exhibit endless variety; being sometimes round or circular, but more frequently ragged and irregular.

There is seldom more than one internal opening; sometimes there are two; and in a case mentioned by Mons. Ribes, there were three. In a sailor, upwards of fifty years of age, on whom I operated for this disease before the medical class in the winter of 1843, there were not less than four internal orifices, situated within a short distance of each other. The aperture is usually soft and irregular, rarely round, or callous. It is commonly situated at the side of the anus, seldom in front, and still more rarely behind.

The point at which the internal orifice opens is worthy of brief notice. Until recently this was supposed to be high up, at the distance of two, three, or even more inches from the external outlet. It is now well ascertained that this is not the case, but that the orifice is generally very low down. Brunel, a physician of Avignon, appears to have been the first to advance this opinion, which has since been fully confirmed by the researches of Ribes.\* This distinguished pathologist has satisfactorily demonstrated that the aperture is almost always situated immediately above the point where the internal membrane of the rectum unites with the skin, sometimes a little higher up, but never more than five or six lines. In eighty subjects in whom this disease was found to exist after death, the internal orifice did not exceed this elevation; indeed, in a considerable number it was not more than a third or fourth of an inch from the anal margin. The testimony of Baron Larrey† is equally strong upon this subject, as is also that of the late Dr. Bushe,‡ of New York. In thirty-five cases, examined by Velpeau,§ either after death or during life, the aperture, in four, was found at a height of from eighteen lines to two inches and a half; in another instance it was elevated more than three inches, and was reached with difficulty by the finger. The others opened at the entrance of the anus, or at the depth of a few lines, as stated by Ribes; three of them even had the orifice on the outside of the villous membrane of this outlet, and only two were found a little nearer to the valve of the sphincter than to the skin. My own observations fully coincide with those of the above writers. In no instance have I found the seat of the internal opening higher up than half an inch, while in the great majority of them it did not exceed two or three lines. In all my operations for this disease, my practice, before dividing the parts, has been, for many years, to expose the internal orifice by means of a flexible director, brought out at the anus; a proceeding which could not be accomplished if the opening were situated at a considerable elevation.

*Congenital malformations*, often incompatible with the perpetuation of the life of the individual, are sometimes witnessed in the anus and lower extremity of the rectum. When the anus is absent, the large bowel is either partly or entirely deficient, or else opens in a cul-de-sac, some distance above the usual place. Occasionally the aperture is closed simply by a thin fold of membrane, not unlike the female hymen, which may be easily divided with the knife, and the infant survive. Sometimes nearly the whole of the large intestine is wanting, as was the case with a fœtus which I dissected a few years

\* Mémoires d'Anatomie et de Physiologie, t. ii., p. 37.

† Mémoires, t. ii., p. 373.

‡ Diseases of the Rectum, p. 248. "In none of nineteen subjects," says this author, "was the internal orifice of the fistula situated higher than in those examined by Ribes, and in the many cases I have operated on, I never found the internal orifice higher up than the region of the internal sphincter and hemorrhoidal plexus."

§ Médecine Opératoire, t. iv., p. 786.

ago, in which the ileum terminated in a capacious cul-de-sac, two inches and a half in length, which floated loosely in the pelvic cavity. At other times, again, the anus and rectum are natural, whilst the colon is either absent or so contracted as to render the continuance of life impossible. Instances are also upon record, where the rectum opened into the urinary bladder, the urethra, or the vagina; thus affording an approximation to the cloaca of birds, and of some fishes.

## SECTION VIII.

### OF INTESTINAL WORMS.

Five species of worms inhabit the intestinal tube of the human subject, the lumbricoid, vermicular, trichocephaloid, the long tape, and the broad tape. These worms are not peculiar to man: they occur frequently in the inferior animals, and, as might be supposed, they all have a decided predilection for particular parts of the alimentary canal, some selecting the small, others the large bowel. How these parasitic beings originate is still a mooted point with pathologists: all are agreed, however, in the belief that they must arise from one of two sources, — either that they must be introduced into the body from without, or else be generated within. It does not accord with the plan of this work to enter into a detail of the various arguments that have been adduced by the advocates of these two questions: suffice it to say, that the great majority of the best writers of the present day are decidedly in favor of the doctrine which ascribes their origin to internal generation. Independently of the fact, that many of these animals have been discovered in a great variety of organs and tissues, both in man, in quadrupeds, birds, reptiles, and fishes, the circumstance that they have been repeatedly seen in the fœtus, seems to be amply sufficient to settle the question as to their origin within the body. Kerkringius mentions the case of an immature fœtus, in whose stomach he found several lumbricoid worms; and instances of tape-worms having been discovered under like circumstances are narrated by Pallas, Heine, and other authors. Rudolphi and Bremser, two highly respectable German writers, refer to numerous examples of worms existing in the fœtuses of various quadrupeds, and also in those of birds which had just escaped from the shell.

The *lumbricoid worm* (*ascaris lumbricoides*, *lumbricus teres*), as its name indicates, is of a cylindrical shape (Fig. 159), gradually tapering towards each extremity. It is marked by numerous circular ridges, and by four longitudinal lines, of which the dorsal and ventral are whitish, the two lateral ones dark and opaque. The head is tri-valvular, without wings or processes; and the digestive tube, which runs in a straight course, terminates a short distance from the tail in a transverse fissure. The length of this worm is from three to twelve inches; its thickness about that of a goose-quill; and its color of a reddish-brown, bordering upon yellow. The male is much more slender than the female, from which it is readily distinguished by the singular curve of its caudal extremity, and by its forked penis.

Fig. 159.



*Ascaris lumbricoides*: *a*, anterior extremity; *b*, posterior; *d*, vulva; *e e*, longitudinal lines.



This species of worm (Figs. 160, 161, 162, 163), exhibits a high degree of organization, being furnished with integuments, a muscular and digestive apparatus, and well-developed sexual organs, together, as is supposed by Cuvier and Cloquet, with a nervous and circulatory system. Its natural residence is in the small intestines, where it often occurs in considerable numbers. It has also been found in the large bowel, in the stomach, biliary ducts, œsophagus, fauces, and even in the larynx. In the latter situation, it has been known to cause suffocation.

Fig. 160.

Fig. 161.

Fig. 162.

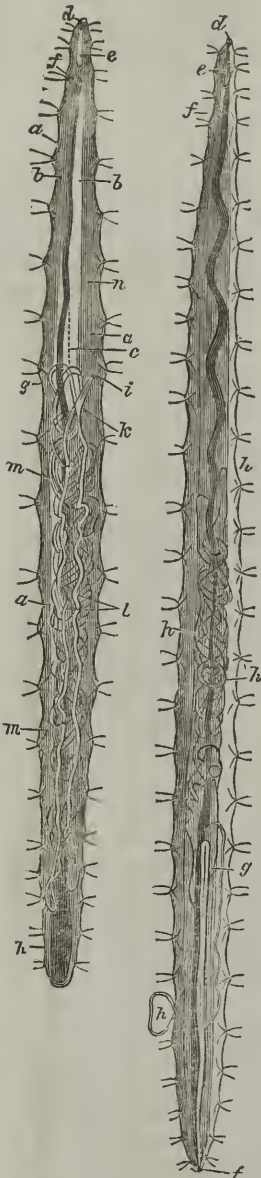


Fig. 160.—Organs of the female ascaris; a, external tunic b b, muscular fibres; d, mouth; e, œsophagus; f, alimentary tube; k l m m, generative organs.  
Fig. 161.—Organs of the male ascaris; d, mouth; e, œsophagus; h h, generative organs; f, intestine; g, penis.



Penis of the ascaris lumbricoides magnified: a, extremity; b, base.

Fig. 163.

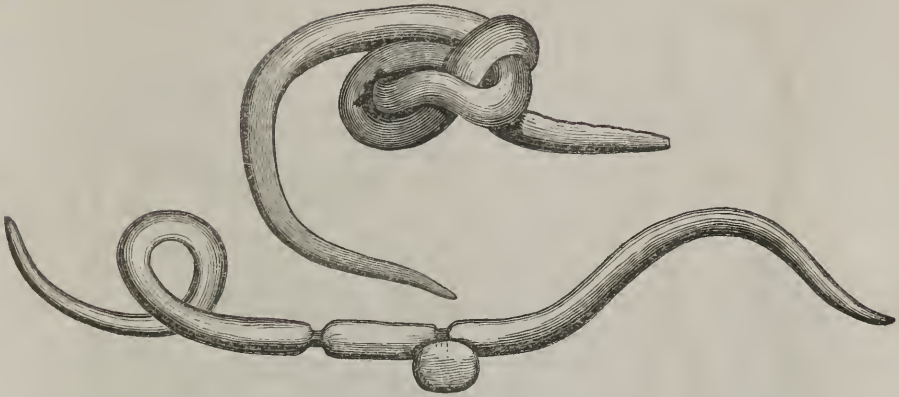


Head and mouth of the ascaris; a, b, tubercles; c, oval aperture.

The usual number of this species of worm ranges from one to two or three dozens. Occasionally, however, it greatly exceeds this. Thus, Dr. Gilli,\* of Turin, saw a child who voided, in the course of eight days, five hundred and ten; and a still more extraordinary case has recently been related by Dr. J. W. Hamilton, of Ohio, in the Western Journal of Medicine and Surgery. In this instance upwards of eleven hundred, from three to nine inches in length, were expelled in less than three months. About sixty, rolled up in a complete ball, came away at one time. The patient was between two or three years of age. The lumbricoid worm is sometimes tied into a knot, as represented in Fig. 164, from a specimen in my cabinet.

\* Brit. and For. Med. Rev., vol. xv., p. 248.

Fig. 164.



The *vermicular species* (*ascaris vermicularis*, *oxyurus v.*, *fusaria v.*), is extremely small and delicate (Fig. 165), the male being not above the sixth of an inch in length, with a very thin tapering body, of a whitish color. The mouth is of an orbicular shape, with a bladder-like, transparent membrane on each side: the tail is spiral and obtuse, and the sexual organ is contained in a sheath. The female is considerably larger, being from four to six lines long, and its tail is as fine as the most delicate needle. The heads of these worms are in constant motion: from this circumstance they are often called leap-worms: from the uneasy, gnawing sensation which they are supposed sometimes to occasion in the stomach, they have also received the name of maw-worms; and, from their filiform configuration, they are vulgarly termed thread-worms. They are found only in the large intestines, especially in the rectum, where they are often collected in vast multitudes, wrapped up in thick, viscid mucus. In females, these worms sometimes pass into the vagina, and give rise to much uneasiness.

Fig. 165.



a, head; b, tail; \*, natural size.

The *trichocephaloid* (*trichocephalus dispar*, *trichuris*, *ascaris trichuria*), *hair-worm*, or *thread-worm* (Fig. 166), as it has been variously denominated, is principally found in the cœcum, and is said to be very common in the inhabitants of England, Ireland, France, Italy, and Germany. It is also frequently met with in the inferior quadrupeds, especially the monkey, dog, and fox. This species is from one and a half to two inches in length, with a white, cylindrical body, which is almost as thin as a horse-hair anteriorly, the remaining third being considerably stouter, and terminating in a rounded extremity. The mouth is orbicular, the head extremely slender, and the capilliform portion transversely striated: the alimentary tube runs in a straight course from before backwards, and terminates in the thick bulbous part, where it assumes a flat, spiral form. The male is the smallest, and is distinguishable from the female by the sexual organs, which are enclosed in a sheath, by the greater

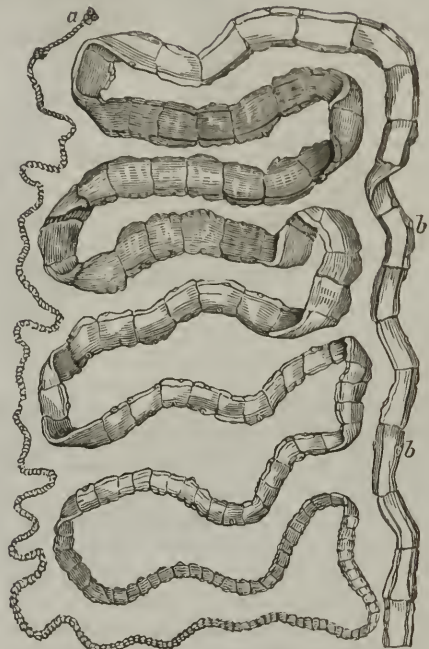
brevity of the anterior capilliform portion, and by the peculiar circular whirl of the tail.

Fig. 166.



\* a, the head; b, intestines;  
c, sheath; d, penis; \*, natural size.

Fig. 167.



\* a, head; b b, lateral orifices.

The *long tape-worm* (Fig. 167), (*tænia longa*, *tænia solium*, *tænia cucurbitiva*), naturally infests the small intestines; but it has also been observed in the stomach, colon, and rectum. This species is of frequent occurrence in different sections of the United States and Europe; and, according to Hasselquest, it is also very common in many parts of the East, especially amongst the Jews at Cairo, large numbers of whom are affected with it. The long tape-worm is of a whitish color, from three to six lines in width, and of the average length of sixty feet. Occasionally the length is enormous. Bremser relates a case where it was one hundred and fifty feet, and others are given where it was above three hundred. Towards the anterior part, this worm suddenly tapers off into a very fine thread-like extremity, which is surmounted by a small hemispherical head, provided with four lateral suckers. The body is flat, rough, and composed of numerous joints, on one edge of which there is a slight projection, pierced by a minute aperture. The con-



figuration of the articulations, their relative length and breadth, are much influenced by the movements of the animal, and cannot be specifically defined. The worm is rarely expelled entire : most commonly it is voided in pieces several feet long, and not unfrequently it comes away in single joints, looking like so many gourd seeds. In its organization it seems to be greatly inferior to the preceding species, being a homogeneous cellulo-gelatinous mass, without distinction of sexes, or trace of a nervous system. This variety of tape-worm seems to be at once androgynous and hermaphrodite, impregnation occurring indifferently by means of the approximation of two individuals, or, as is probably more commonly the case, by that of two joints of the same animal.

The *broad tape-worm* (*tænia lata*, *bothriocephalus latus*, *tænia membranacea*) seldom exceeds fifteen feet, though occasionally it attains a much greater length. It is white, flat, from six to ten lines in width at the broadest part, which is near the middle, and consists of a series of concatenated joints, the intervals between which grow successively longer the nearer they approach the tail. In its general features, it bears a pretty close resemblance to the long variety ; but the articulations are comparatively larger and stronger ; the flattened surface of each link is perforated by a small hole, and the head of the animal (Fig. 168, *a a*), when seen by means of a lens, is found to be an elongated, elliptical shape, with a large fissure on each side of it. Both extremities are remarkably attenuated, especially the anterior, which is often perfectly thread-like for twelve or fifteen inches. This worm inhabits the upper portion of the small bowel, and is very common in France, Switzerland, Poland, and Russia, several of them often coexisting in the same individual.

Fig. 168.



Of the hundred and one *symptoms* which have been enumerated by authors as indicative of the presence of worms in the alimentary tube, there is only a single one that is of any value, and that is the appearance of these bodies in the evacuations. All the other phenomena are of negative importance, as they may result from any irritation of the mucous membrane. The functional symptoms of worms appear to vary according to the particular species. Thus, the vermicular variety induces the most distressing itching and titillation in the lower part of the rectum and anus ; the tænia, twisting and gnawing in the vicinity of the stomach, with enormous appetite, and irregular retraction of the abdomen ; the lumbricoid, pain and itching about the navel. Worms are supposed by some to be harmless inmates of the intestinal tube, — an opinion the fallacy of which has been abundantly proved by the united experience of the profession. If allowed to remain unmolested, they not only create irritation in the mucous membrane, but cause a variety of sympathetic disorders which evolute either in the impairment of the general health, or even in the destruction of life. Of this description are chorea, paralysis, mania, epilepsy, hydrocephalus, with a variety of other affections which it would be needless here to specify.

## CHAPTER XXI.

## OF THE PERITONÆUM.

Is liable to different forms of Disease. — Acute Inflammation. — Deposition of Lymph. — Effusion of Serum, Pus, and Blood. — Softening of the Subserous Cellular Tissue. — Parts of the Membrane most apt to suffer. — Development of Vesicles. — Chronic Irritation. — Agglutination of the Bowels and formation of False Passages. — Tubercles. — Ascitic Effusions. — Generation of Gas. — Heterologous Growths.

THE lesion of the peritonæum may be referred to inflammation, tubercles, melanosis, and cancerous growths. A very brief description of these several pathological states is all that will be attempted in this place.

The common characters of *acute inflammation* are increased vascularity, opacity, exudation of lymph, and effusion of serous fluid. The redness is generally of a florid tint, and is either punctiform, arborescent, stellated, or patch-like, being always most intense in those cases where there is least secretion. Under opposite circumstances, indeed, the redness is sometimes scarcely perceptible, and may even be entirely absent; not so much, perhaps, from the reflux of blood from the capillaries during the agonies of death, as from the manner in which they are drained during the violence of the inflammatory excitement. This conclusion, I am aware, is opposed to that of Dr. Scoutetten,\* a highly respectable French writer, who asserts that there is always increased redness after death; but that this is not the case must be familiar to every pathologist, however limited his observations.

Occasionally small ecchymoses are observed; and, in almost all cases, the membrane loses a considerable share of its transparency, assuming an opaque, turbid, or milky aspect. Much has been said by writers concerning the thickening of the peritonæum in this disease; but if this condition ever occurs, I have not been so fortunate as to witness it, and am seriously inclined to doubt whether it ever takes place.

By the time the redness is fairly established, the affected membrane throws out coagulating lymph and serum. Whether both these substances are separated simultaneously, or one precedes the other, are points which do not seem to be fully settled. The late Dr. Armstrong, of London, well known as one of the ablest physicians of the age, was of opinion that the lymph is deposited first; whilst others maintain that the priority, if any, is always determined by the intensity of the inflammation. According to this theory, when the disease is very mild, serum seems to be thrown out first; but, if the excitement is very acute, the earliest product is lymph.† After all, this is a mere hair-splitting affair, in which the wisest plan is to pursue a middle course, as the question cannot be easily decided without numerous experiments upon the inferior animals. To me it appears more than probable that both substances are eliminated at one and the same time, as we have reason to believe they are in the pleura and pericardium.

At first, the lymph has a soft, unctuous feel; but by degrees it becomes dense, firm, and organized, vessels being either developed in its substance, or else shooting into it from the surrounding parts. The period at which it is

\* Archives Générales, t. iii., p. 501.

† London Cyclopædia of Practical Medicine, art. *Peritonitis*, p. 302.

vascularized varies in different cases, from thirty hours to several days, weeks, or even months. Of the numerous forms which this matter assumes, the band-like is by far the most common. (Fig. 169.)

Not unfrequently, however, we find it deposited in small amorphous masses, filling up the intervals between the convolutions of the intestines, and gluing them more or less closely together. In many instances, from the presence of this substance, all the abdominal viscera present one uniform surface, with extensive adhesions to the surrounding walls.

When partial, these peritonæal adhesions sometimes induce fatal mischief, by strangulating the bowel.

The lymph is sometimes deposited in distinct layers, varying in thickness from the finest silk to the coarsest cassimere. Of a light greyish tint, they are perfectly smooth and transparent, and often contain long, slender vessels, filled with florid blood. Such adventitious membranes, from the manner in which they are attached to and spread over the surface of the bowels, may form small pouches, distended with serous fluid.

The *serum* poured out in this affection varies in quantity from a few ounces to several pounds, being always much less than in chronic peritonitis. In its color, it differs in different cases. Sometimes, especially when the inflammation is partial, it is clear and limpid, like water; at others, it is of a pale reddish hue, whitish, or milky, and not unfrequently it is mixed with flakes of lymph, or possesses all the sensible properties of pus.

The effusion of *pus* is a frequent termination in fatal cases, and seems to take place occasionally at a very early period of the disease; but in general it is not considerable in quantity until the affection has existed for some time. As there is no breach of continuity in the membrane, the matter is probably thrown out by a sort of exhalation, similar to that which is concerned in the production of the serum and lymph. The color and consistence of the pus are various, being white, greenish, milky, or reddish, with shreds of membrane, flakes of lymph, or dots of blood.

In very violent grades of this disease, it is not uncommon to find *clots of blood*, sometimes of considerable size, in the serous cavity. This appearance, which has been repeatedly observed by Broussais and others, has been several times witnessed in my own dissections. In a middle-aged man, whom I examined a few years ago, along with the late Dr. Herron, of Cincinnati, the peritonæum exhibited all the marks of high inflammatory action; and, although there was no breach of continuity or ruptured vessel, as, indeed, there rarely is in such cases, yet there were nearly two pounds of coagulated blood in the left iliac region.

There is another pathological state which is not unfrequently witnessed in connection with peritonitis, and which is of too important a character to be passed wholly unnoticed on this occasion. I allude to the softening of the subserous cellular substance. This lesion, although principally observable in

Fig. 169.





the acute form of the disease, is by no means peculiar to it. It is generally associated with sero-purulent effusion, and is particularly conspicuous in the pelvic portion of the peritonæum, in the persons of lying-in females, and in those who fall victims to injuries of the rectum and urinary bladder. The softening, which sometimes involves a large extent of surface, often amounts to such a degree as to permit the serous membrane to be peeled off with the greatest facility from the organs which it serves to envelope. This lesion, which appears to have been known to De Haen, has been particularly pointed out by Hodgkin; but I had met with it several times before the excellent work of that distinguished anatomist fell into my hands. A similar pathological condition is occasionally seen concurrently with the preceding, in the submucous cellular substance of the stomach and bowels, produced, in all probability, by an extension of the irritation from the serous envelope.

All parts of the peritonæum are not equally liable to inflammation: the portions most commonly affected are the broad ligaments of the uterus, and the covering of the small intestines, especially of the ileum, together with the tunic of the spleen and liver. Rarely is the parietal part of the membrane implicated; and the same remark is applicable, in a still higher degree, to the serous envelope of the stomach. Indeed, serous gastritis must be regarded as an extremely infrequent disease, infinitely more so than is generally imagined by the profession. In all my dissections, I cannot recall a single instance in which this portion of the peritonæum betrayed the least sign of acute inflammation. True, the organ is occasionally found glued to the neighboring structures, as the spleen, diaphragm, or arch of the colon; but even this circumstance is far from affording conclusive evidence that it was the seat of the effusion which led to this pathological condition.

Nor does the disease always remain confined to the original seat of the attack. Thus it often happens that the external coat of the bowel is inflamed in the first instance, and that the irritation is afterwards propagated, either rapidly, or step by step, as it were, to the other layers, or even to the wall of the abdomen.

On some occasions, the peritonæum is elevated into little *vesicles*, produced by an evolution of air in the subjacent cellular tissue. Gendrin\* states that he has several times noticed this phenomenon in his experiments on inferior animals; and, he moreover adds, it is very often met with in the violent inflammations which supervene upon intestinal effusions. Another phenomenon, which is sometimes noticed, is the development of gas, either in the peritonæal sac, or in the digestive canal, or in both these cavities simultaneously. How this fluid originates, it is not very easy to determine: perhaps, however, it would not be going too far to suppose that, in some instances, it is the result of a true secretion, whilst, in others, it is separated from the effused liquids and alimentary substances.

Bold and well-marked *symptoms* often usher in this disease; nevertheless, its progress is frequently insidious, and the phenomena, both local and general, such as not to afford any satisfactory indications of the mischief that is going on in this important membrane. Thus, there may be little or no gastric irritability, little or no pain, little or no derangement of the bowels. Towards the close of the disease, however, there is usually vomiting, a tense and tympanitic condition of the abdomen, an anxious and contracted state of the features, great prostration of strength, and pain, on pressure, over the region of the belly, with diarrhœa or constipation. Often, the least pressure is insupportable, and even

\* Histoire Anatomique des Infl., t. i., p. 138.

the weight of the bed-clothes is distressing. The pain, though occasionally wandering, is generally fixed, acute, and constant; and the patient rarely lies in any other position than on the back. The formation of matter is indicated by irregular chills, diminution of the abdominal pain, with a sense of weight and oppression, pallor of the countenance, and coldness of the extremities.

The presence of plastic lymph, with partial adhesions, is indicated, at an early stage, by a remarkable symptom, which was discovered, a few years ago, by that eminent pathologist, Dr. Bright, of London. It consists in a peculiar crepitating sensation, not unlike what is produced by bending a sheet of new leather, which is recognized by the hand when applied to the abdomen in a mode calculated to facilitate motion. It has also been likened to the obscure creaking of pulmonary emphysema, and to the sensation caused by passing a wetted finger over a pane of glass. It is felt both during the ascent and descent of the diaphragm, but more distinctly during the latter, and appears to result from the friction of the roughened surfaces of the peritonæum. This symptom, it should be added, is to be perceived only when the lymph, upon the presence of which it depends, is of a plastic, organizable character, competent to form adhesions, and never lasts beyond a few days.

The bowels, in this disease, as we have already seen, are sometimes firmly agglutinated to each other, and to the parietes of the abdomen. When this happens, the diagnosis, as might be expected, must be extremely obscure and difficult. Indeed, there is no symptom or group of phenomena, upon which we can place any special reliance. Dr. Armstrong says that such adhesions may generally be suspected by an irregularly lobulated state of the bowels, perceptible on passing the hand over the abdomen; but this sign is by no means constant, even in recent cases, whilst, in those of longstanding, or in which the adventitious substance is in great measure absorbed, or transformed into the cellular and serous tissues, it is generally entirely wanting. Occasionally, though rarely, the patient experiences a sensation, as if a ball were rolling about the abdomen. The caliber of the bowels is often very much diminished; and these organs are either habitually torpid, or very much relaxed.

Acute peritonitis generally ends favorably or fatally in from five to ten days from its invasion. Occasionally it is disposed to run into *gangrene*. This termination, which is more liable to occur here than in any other serous texture, is anatomically characterized by the black, greyish color of the affected part, by its soft, pulpy consistence, by its disagreeable, fetid odor, and by the facility with which it can be scraped off from the subjacent structures. If there be any adventitious membrane, it usually participates in the disorganizing process, assuming the same appearances as the pre-existing texture.

In *chronic* peritonitis, the affected part is of a dark color, the vessels are more dilated, and the subjacent cellular tissue is more dense and thick. The serous texture itself is sometimes hypertrophied, not uniformly, but in patches; this effect, however, is by no means so well marked as is asserted by pathologists, and, in fact, is often entirely absent. Brownish, greyish, bluish, or dark slate-colored spots, are frequently observable in this affection, and might be mistaken by the young anatomist for gangrenous eschars; from which, however, they can be easily distinguished by their firmness, want of odor, and great extent, the whole peritonæum being occasionally marked with them. But we must not always expect to find the membrane discolored; for, in protracted cases, it is more common to witness the opposite state, the affected parts being unusually white and milky.

The false membranes are often very thick, forming large masses of fibro-cellular substance, by which the abdominal viscera are agglutinated into one ge-

neral mass. When these structures ulcerate, their ordinary color is a dirty green ; but they may also present various shades of yellow, grey, and brown, especially when, as sometimes happens, they are much impregnated with blood. Occasionally these membranes do not become organized, but have a friable, rotten aspect. Masses of this description have been found, from two to three inches thick, overspreading the whole peritonæum like a poultice of mashed carrots.\*

The plastic lymph which is thus poured out not only serves to agglutinate the abdominal viscera more or less firmly to each other and to the enclosing parietes, but it occasionally becomes the seat of fistulous tracks, having either the arrangement of a blind sac, or communicating at each extremity with the intestinal tube. In the only instance in which I have observed this condition, and the only one, indeed, of which I have any knowledge, the canals were of an irregularly cylindrical shape, from two to four lines in diameter, and from two to nine inches in length. The course of all, five in number, was remarkably tortuous. The principal one extended in an oblique direction over the anterior surface of the small bowel, from the sigmoid flexure of the colon towards the right side of the abdomen ; where, after a distance of six inches, it terminated in two branches, each three inches in length ; one of which opened into the upper part of the jejunum, the other into the upper part of the duodenum. The internal surface of these channels was somewhat rough and fleecy, as if lined by a mucous membrane : their parietes were of a fibro-cartilaginous consistence and insensibly blended with the surrounding adventitious textures. At the time of making the examination, they all contained a small quantity of fecal matter, of the same nature as that found in the small and large intestines.

The manner in which these new channels are formed may be explained in one of two ways. In the first place, we may suppose that they are generated under the immediate influence of ulceration and perforation of the bowel. Under ordinary circumstances, the consequence of such an event would be an extravasation of fecal matter into the peritonæal sac, rapidly followed by fatal inflammation. But, in a case like that before us, no such occurrence, it is obvious, could possibly take place, owing to the manner in which the intestinal coils are tied together. Hence, when the bowel becomes perforated, its contents, instead of escaping into the abdominal cavity, find their way into the connecting adventitious substance, where they excite ulcerative absorption, and thus gradually generate passages of communication between different parts of the alimentary tube. What countenances this view is the fact that, in the interesting case which fell under my observation, there were numerous ulcers both in the small and large bowel, and that the new channels all opened into these reservoirs. The individual, a patient of Professor Drake, was about twenty-eight years of age, during the four last of which he had been harassed almost incessantly with a griping diarrhœa, the relic apparently of a severe attack of Asiatic cholera, complicated with acute peritonitis. Latterly, whenever he took food, it would generally in a few minutes pass by the bowels, in the state in which it was swallowed. All the abdominal viscera were firmly and inseparably matted together ; and the caliber of the whole intestinal tube was contracted to nearly one-half the original volume. In different parts of its extent the new substance was studded with hard, greyish, miliary tubercles, distinctly encysted, and many of them as large as a common pea.

We may suppose, secondly, that these fistulous tracks are formed under the influence of purulent matter, poured out either simultaneously with the plastic lymph in which they are situated, or subsequently to the establishment of adhe-

\* Hope, Principles of Morbid Anatomy, p. 224.



sions. The fluid which is thus accumulated, instead of being absorbed, or extravasated into the peritonæal sac, works its way into the neighboring intestinal coils, through which it finds a ready outlet. In proportion as the contents of the abscess are evacuated, fecal matter passes in and supplies their place; for the opening in the bowel, being prevented from closing up, remains permanently patulous. According to this theory, the ulceration of the intestinal tunic, it will be observed, is supposed to be consecutive to the formation of the fistulous tracks.

Cases are observed in which these membranes, both natural and adventitious, are of a fibro-cartilaginous consistence; and a very common occurrence is the development of *tubercles*, either upon their surface, or in their substance. In their size these bodies vary between a mustard-seed and a common pea; and in several instances I have found them so numerous as to cover nearly the whole peritonæum, thousands of them being visible in every direction, both on the visceral and parietal portions of the membrane. In a case which I recently examined, the tubercles were in every stage of development, from the consistence of recent lymph to that of fibro-cartilage. Many of them were confluent, like the pustules of small-pox, and not a few appeared to have vessels shooting into them from the surrounding parts, which were highly vascular, as well as considerably thickened.

Although there is no part of the peritonæum which is entirely exempt from these heterologous bodies, yet they appear to be much more liable to occur in some situations than in others. In my own dissections, I have constantly found them more abundant, larger, and more distinctly developed, in the iliac and pelvic portions of the membrane than at any other points. They are also frequently seen on the mesentery, the omentum, and the serous coat of the spleen. In the early stage of their formation, they are so soft as to be easily wiped away; but they gradually increase in density, and may finally assume a fibro-cartilaginous, cartilaginous, and even bony hardness. In some instances they have the consistence of putty, dry curds, or of semi-concrete mortar. The older ones are generally distinctly encysted, the enveloping membrane, which is very thin and delicate, being evidently of new formation; those, on the contrary, which are more recent, are unprovided with such a covering, and appear to consist merely of little masses of plastic lymph in a state of incipient organization. No particular symptoms are occasioned by the presence of these bodies; in the generality of cases, they occur in scrofulous subjects, in connection with tubercles of the lungs, spleen, liver, and other organs.

The effusion in chronic peritonitis may be perfectly clear and limpid; more commonly, however, it is of a greenish tint, white or milky, and blended with purulent matter, or flakes of lymph, or both together. Occasionally we find it reddish, from the exhalation of blood. The accumulation of watery fluid is sometimes immense. Dr. Cordes, of Hirschberg, in Germany, mentions a case, in which the patient, a female, forty years old, was tapped in the short space of eighteen months, fifty-nine times, and five hundred and sixty-nine quarts of water drawn off.\* A still more remarkable instance has been recently detailed by Dr. Beall,† of Missouri. The patient, a gentleman, whose age is not stated, was tapped ninety-six times within a few years, and the whole amount of fluid evacuated was two hundred and seventy-five gallons and a half, the first fifteen operations yielding an average quantity of twenty quarts!

The diagnosis of ascitic effusion is usually unattended with much difficulty. The only state, indeed, with which it is liable to be confounded is pregnancy.

\* Walthers and Græffe's *Journal der Chirurgie*, &c. 11 ter. B.

† *Western Journal of the Medical and Physical Sciences*, vol. x., p. 343.

From this, however, it may in general be easily distinguished, first, by the history of the case; secondly, by the fluctuating nature of the tumor; thirdly, by the subsidence of the fluid to the more dependent parts on varying the posture of the patient; fourthly, by the effects of hydragogue medicines: and, lastly, by the absence of the ordinary symptoms of gestation. In a few instances, I have been able, by applying the ear to one side of the abdomen, and striking the other with the fore and middle fingers, to recognize a peculiar plashing noise, similar to what results from the agitation of a half empty cask of water. Percussion produces a dull, flat sound, which is always most distinctly marked in the hypogastric region, as it is here that we usually find the greatest degree of accumulation. Higher up, the sound is commonly somewhat sonorous or *humoric*, as it has been styled by M. Piorry, from the presence of the intestines, which, on account of the gaseous nature of their contents, generally follow the upper level of the effused liquid.

There is a singular circumstance connected with the present topic deserving of brief notice in this place. I allude to the fact that the water in ascites occasionally exerts such a degree of pressure upon the recto-vaginal portion of the peritonæal sac as to make the perinæum bulge out in the form of a tumor. This singular lesion was first accurately described, I believe, by the late Dr. Denman, of London, in his excellent work on midwifery, though it had been incidentally noticed by other writers. The swelling varies in size between an orange and a fœtal head, and is generally of an irregularly oval figure, like the urinary bladder: it distinctly fluctuates under the finger, and disappears temporarily on pressure. When large it is translucent, and projects forward so as to occlude the mouth of the vagina. The internal coat of the tumor is formed by the peritonæum, the external by the perinæum, which is sometimes inverted.

Gas is also occasionally generated in this disease, and in some instances it has been known to possess the odor of sulphuretted hydrogen. It generally occurs in connection with sero-purulent effusions, and is most common in that variety of peritonitis which is primitively chronic. Broussais and Scoutetten state that they have sometimes seen minute, yellowish vesicles, filled with limpid serum, and bearing a considerable resemblance to hydatids. None of these appearances have ever been witnessed in my own dissections, and I presume that they are very rare. The same may be said of ulceration of this membrane, a lesion which has been observed several times by Portal, Bonet, and Scoutetten.

In chronic peritonitis, when matter is formed in the abdominal cavity, it sometimes works its way along the spermatic cord, and points externally. Dr. Gordon, of Edinburgh, relates several cases in which it escaped at the umbilicus, and another in which it found an outlet through the urethra. A person thus circumstanced may live a considerable period with a fistulous opening, or fatal inflammation may arise from the ingress of air.

This disease may exist as an intra-uterine disorder. Of this several interesting examples are detailed by Morgagni and Billard. The children were pale and emaciated, and thick, old membranes were found in the abdomen, agglutinating the viscera so firmly together that it was difficult to separate them. Even tubercles, such as we have briefly described them, have been detected in several instances in children that have died within a few hours after birth.

Chronic peritonitis often lasts for a considerable length of time, and is occasionally extremely obscure and insidious in its nature. These characters are well shown in a case mentioned by Dr. Abercrombie. A young lady, aged sixteen, had been observed for several weeks to lose flesh and strength, with

listlessness and impaired appetite. She became easily fatigued by exercise, had a hectic look, a foul tongue, and a pulse of one hundred and twenty in a minute: the abdomen was tumid and somewhat tender on pressure, but otherwise she did not seem to suffer any inconvenience.

These symptoms continued from the fifth until about the fifteenth of April, when she seemed to improve somewhat in spirits, strength, and appetite; but the pulse remained frequent, being generally from one hundred to one hundred and twenty, and the abdomen retained a considerable degree of tympanitic fulness. The bowels were regular in their action, and, excepting some griping pain, there was no particular uneasiness. In May, she became worse, the emaciation and debility gradually augmenting, but still there was no local pain. At the end of the month she had some vomiting and occasional diarrhœa, the former of which became more and more frequent until at length she was unable to retain any thing on the stomach. She expired early in June, having been confined to bed only a few days.

On inspection, the contents of the abdomen presented one solid mass of adhesion, in which it was impossible to distinguish one intestine from another. The mass likewise adhered extensively to the walls of the abdomen; and in various parts of it were small cavities, containing purulent matter, and exhibiting on their surface unhealthy scrofulous ulcerations. The liver was considerably enlarged, as were also the mesenteric glands, and much pus was found in the pelvis.

*Cartilaginous and osseous concretions*, although infrequent, are occasionally found in the peritonæal cavity, accompanied or not by lesion of the abdominal and pelvic viscera. Generally loose and floating, they are sometimes attached by a sort of foot-stalk to the free surface of the serous membrane, and at other times enclosed in the sub-serous cellular tissue. In their form they are irregularly rounded, oblong, flattened, or ovoidal, and in their volume they vary from that of a pea to that of a small walnut. Smooth and polished externally, they are commonly composed of a mass of cartilage arranged around a bony nucleus; they are of a dull whitish, greyish, or pearly appearance, firm, compact, and occasionally, though not always, elastic. Andral\* met with a concretion of this kind, in the centre of which there was a cavity filled with sebaceous matter. Velpeau† describes one which was of a fibrinous structure, and appeared to have been nothing but the remains of an ancient clot of blood. Elastic, and very dense, it was softer at the centre than at the surface, and yielded readily under the pressure of the finger. It was smooth, yellowish, of the form and volume of a large chesnut, entirely isolated, and interposed between the cœcum and spinal column. In a case mentioned by Lebidois‡ the concretion, of the volume of a very large nut, hard, compact, and elastic, was surrounded by a cyst, situated beneath the spleen: a similar substance, only smaller, and enclosed in a very loose cellululo-vascular capsule, existed between the bladder and the rectum. Simonin§ relates an example, in which two bodies of this kind were found in the right side of the pelvic cavity, perfectly free, of the volume and form of small horns, invested by a smooth, glistening membrane, and composed of cartilaginous osseous tissue. One of them, of a brown-greyish color, and weighing nearly two scruples, was two inches in length by six lines in diameter at the middle. Three small bony concretions likewise existed in the right pulmonary pleura. The patient, a man sixty-two years of age, had died of softening of the

\* Treatise on Path. Anatomy, by West, vol. i., p. 213.

† Dict. de Médecine, t. i., p. 207.

‡ Dict. de Méd., t. i., p. 207.

§ Annales de Chirurgie, t. i., 223.



heart. Dr. Hodgkin\* states that he has met with these concretions in three different situations, between the folds of the great omentum, in the pelvis, and on the convex surface of the liver, between it and the diaphragm.

Andral† considers these concretions as of frequent occurrence. "I have often found them," says he, "in the peritonæum, sometimes perfectly isolated from all the solid parts, and at other times appended to a peculiar prolongation of the serous membrane." I have never met with them, nor have any of my friends been more fortunate; and judging from the general silence of pathologists upon the subject, I should regard them as of very rare occurrence.

The peritonæum, like the pleura and pericardium may contain air, or *gas*, either introduced from without, or generated within. Although pneumatosis of this cavity, as a product of exhalation, has been denied by Willis, Littre, Abercrombie, and other highly respectable authorities, we have nevertheless sufficient evidence of its occasional occurrence, if we credit the observations of Heister, Baillon, Lieutaud, Merklin, Frank, Portal, Combalusier, Krzowitz, Katelbach, Schulz, Albers, Bell, Gendrin, and Graves. In a majority, however, of the cases recorded by these distinguished pathologists, the affection co-existed with serous fluid, blood, lymph, or purulent matter; and hence many writers have been induced to believe that the gas was the result rather of a chemical than of a vital process. Be this at it may, there is reason to believe that, when the accumulation is of a spontaneous nature, it is generally connected with inflammation, sub-acute or chronic, of the serous membrane. When the air is introduced from without it usually finds its way in from the alimentary tube through an ulcer or perforation, which may be small and difficult to detect. The quantity of fluid may be very trifling, or it may be so great as to cause severe suffering and even death. The gas is occasionally very offensive, from the presence of the sulphuretted hydrogen, and escapes, when the abdomen is punctured, with a loud hissing noise.

*Melanosis* is sometimes found after chronic peritonitis, the form in which it is poured out being liable to considerable variety. It may occur as an infiltration in the connecting cellular tissue; but more commonly it is deposited upon the free surface of the serous membrane, and observes a punctiform, stratiform, or nodulated arrangement. The parts of the peritonæum most prone to melanosis, are the great omentum and the epiploic appendages of the colon, from the predilection, probably, which this substance has for the adipous tissue. In the nodulated variety, the tumors, whether isolated or agglomerated, generally adhere by small foot-stalks, and are enveloped by cysts of fine cellular tissue, often furnished with delicate vessels. When in layers, this substance is covered by a thin film of membrane, and is liable to be confounded with common hemorrhagic effusions, altered in their color by the chemical action of certain acids and gases, developed either in the intestinal tube, or in the peritonæal cavity.

*Scirrhus*, *steatomatous*, and *encephaloid tumors* sometimes grow from the peritonæum, so large as to encroach very materially upon the abdominal viscera. Of the two first varieties of disease I have never seen an example; of the latter, an interesting specimen was transmitted to me, about eighteen months ago, by Dr. George E. Conant, of Huntington, in the State of Ohio. It was taken from the body of a little girl, five years of age, and weighed eleven pounds nine ounces. It occupied the whole abdominal cavity, ex-

\* Lectures on the Morbid Anatomy of the Serous and Mucous Membranes, vol. i., p. 160, London, 1836.

† Op. cit., p. 213.

tending from the ensiform cartilage low down into the pelvis, concealing the small bowels, and adhering to the great omentum — from which it seemed to originate — the uterus, the urinary bladder, and the parietal portion of the peritonæum. The tumor is of a whitish yellow color, lobulated, soft and doughy, with numerous vessels, of a large caliber, ramifying over its outer surface. Internally, it has a distinctly fibrous arrangement, and contains numerous little cells, some of which are filled with pus, some with a thin, turbid sanies, some with blood. This immense encephaloid mass could be easily felt through the abdomen during life, and its presence occasioned, especially towards the last, the most frightful dyspnœa, together with great emaciation and gradual exhaustion of the powers of the system.

The most ordinary form in which the encephaloid matter occurs is that of small tumors, from the size of a bean to that of an egg. Their shape is either spherical or pear-like, and their number is often quite great, from twenty to a hundred being found in the same individual. They are generally of a dull white color, mottled with dark modena spots, are surrounded by a very delicate yet distinct membrane, and are penetrated at different parts of their circumference by minute florid vessels, which thus supply them with blood. The contents of these tumors are subject to considerable variety; for, whilst some are composed almost wholly of cerebriiform matter, others are made up of a soft grumous substance, or of a fluid closely resembling thin jelly or half-boiled arrow-root. On some occasions they are exceedingly vascular, and present an appearance very much like that of the spleen. These heterologous growths are frequently observed on the visceral portion of the peritonæum, and they generally coexist with similar formations in other parts of the body.

## CHAPTER XXII.

### OF THE BILIARY APPARATUS.

#### SECTION I.

##### OF THE LIVER.

I. *The Liver.* — Situation, Color, Dimensions, and minute Structure of the Liver. — Analysis. — Has two Envelopes. — Lesions. — Inflammation. — Suppuration and Abscess. — Gangrene. — Softening. — Induration. — Hypertrophy and Atrophy. — Cirrhosis. — Tubercles. — Carcinoma. — Melanosis. — Hydatids. — Adipous Transformation. — The Liver Fluke, and other Worms. — Cartilaginous Degeneration. — Osseous Concretions. — Sanguineous Effusions. — Erectile Tumor. — Restorative Powers of the Liver. — II. *The Gall-Bladder.* — Inflammation. — Ulceration and Rupture. — Atrophy and Thickening of its Coats. — Diseases of the Biliary Ducts. — Alterations of the Bile. — Gall-stones.

THE liver, situated in the right hypochondriac region, also in part in the epigastric and left hypochondriac, is a large glandular organ, from ten to twelve inches in breadth, from six to seven in length, and from two and three-quarters to three and a half in thickness. In *weight*, it varies from two pounds and three-quarters to three pounds and a half; consequently, it may be said to constitute about the thirty-fifth part of the entire weight of the human frame. Its volume, however, is much influenced by the state of its

own circulation; a circumstance which might be anticipated from the immense quantity of blood which is continually poured into it by the hepatic artery and portal vein. Of the extent of this influence, a good idea may be formed by removing the liver from the abdomen and washing out its fluids, when its bulk will be found to be considerably diminished, as is shown by its collapsed and wrinkled aspect. Nor is this all. Whatever has a tendency to retard, interrupt, or prevent the return of the blood from the hepatic veins to the right side of the heart, must induce congestion, with all its necessary evils, in the organ under consideration. Hence it is found that disease of the liver is often directly dependent upon lesion of the heart or large veins.

That the *color* of the liver, the next subject to be noticed, should be modified, and, if I may so express myself, controlled by the amount of blood which it receives, no one can for a moment doubt. Accordingly, we find, that, in the fœtus, in which the liver is always remarkably vascular, the color is much more florid than some time after birth, or in the subsequent periods of life. In the adult, it is generally of a reddish-brown, with spots of blue, particularly along the anterior margin and under surface. In persons who are hung, the liver is usually of a deep pink color, — sometimes quite purple. Such, in a few words, is the healthy complexion of this important organ. How it is altered by disease will appear in the sequel.

In simple *congestion*, the hepatic tissue is generally of a florid red, the arteries and veins are preternaturally distended, and blood flows freely on making sections of it. By a careless observer, this condition of the liver might be confounded with inflammation, but may be readily distinguished from it, by the greater uniformity of its color, by its pervading the entire organ, and by the facility with which the blood may be squeezed from its vessels. Dr. Kiernan, of London, has recently shown, that, when the congestion results from the portal veins, the granules are the parts which are most vascular; whilst, when it is caused by the hepatic veins, it is most distinct in the intervening cellular tissue. When both systems are filled with blood, the redness will be equally conspicuous in both textures.

The *parenchymatous structure* of the liver is very fragile and lacerable, yet so compact that it cannot be much compressed. When torn, it assumes the appearance of small polyhedral granules, each of which may be considered as a perfect gland, as it is furnished with an appropriate excretory duct, together with nerves, bloodvessels, and absorbents. Their size equals that of a millet-seed, and their number is incalculably great. Lodged each in a distinct capsule of cellulo-fibrous substance, they are usually of a lighter color than the surface of the liver, and appear to be porous when divided. Whether this is really the case, however, is a point upon which anatomists are still undecided. Around them may be observed, in a collapsed state, the branches of the portal vein, accompanied by those of the hepatic artery and hepatic duct, the latter being frequently distinguishable by the exuding bile.

An important question here arises, not only in a physiological but also in a pathological point of view, namely, — are there two distinct sets of granules in the liver? Ferrein, Meckel, Andral, Hope, and other highly respectable anatomists, think that there are, and, in support of their opinion, allege that, in certain diseases of the organ, they are distinctly perceptible, one being yellow, the other red. Without entering into an elaborate discussion of the subject, which the limits of this work would render improper, I shall content myself by observing, that so far as my own researches go, I see no reason for adopting the sentiments of these eminent authorities. Nor am I singular in my want of orthodoxy upon this point. Cruveilhier, a most accomplished



anatomist, positively asserts, upon the evidence of a series of the most carefully conducted observations, that there is only one order of hepatic granules, lying in juxtaposition, and having each a cellulo-fibrous envelope.\* The same sort of testimony is borne by Dr. Kiernan, in his admirable monograph on the structure and functions of this organ, published in 1833. He states that he has satisfied himself by repeated injections, by examinations with the microscope, and by experiments on living animals, that the two species of granulations described by Andral and others, are perfectly identical, both in their texture and office; and he attempts to account for the error into which they have fallen, by referring the difference of appearance to a difference of congestion, the color of these bodies being red when the portal capillaries are engorged, but light yellow when there is distention of the minute branches of the hepatic veins.

In the liver of the hog, in which these granules are unusually distinct, and of a polyhedral form, I have repeatedly looked for these two orders of acini, but never, in a single specimen, have I been able to make them out. For this reason, therefore, as well as from the testimony of the French and English anatomists whose names have been quoted, I am warranted in the conclusion that they do not exist.

In the infant, the acini are much less distinct than in the adult. When a section is made, the parenchymatous substance seems to be much more homogeneous; and, if torn, it does not exhibit such a well-marked granular aspect. Its consistence, also, is more tenacious, and the organ is much less liable to rupture from accident.

The human liver has been subjected to chemical *analysis*, and the result shows that in 100 parts there are, of

Water	-	-	-	61·79
Solid matters	-	-	-	38·21

Of 100 parts of the solid matters, 78·18 are soluble in both water and alcohol; and consist of osmazome, stearine, elaine, resin, oleic and margaric acids, gelatine, and salivine: 28·72 are insoluble: and 2·034 are salts, namely, chloruret, phosphate of potash, phosphate of lime, and oxide of iron.

The liver of the bullock, analysed by Braconnot, consists of

Water	-	-	-	-	68·64
Albumen	-	-	-	-	20·19
A substance containing little nitrogen, very solu- }					6·07
ble in water, and slightly soluble in alcohol }					
Fatty matter	-	-	-	-	3·89
Chloride of potassium	-	-	-	-	0·64
Lime, with iron	-	-	-	-	0·47
Salt of potash in union with a combustible acid					0·10
					<hr/> 100·00

Frommherz and Gugert found both casein and salivary matter in the human liver; but their observations have not, I believe, been confirmed by other chemists. The liver of the cod and of some other fish contains an immense quantity of elaine. From the liver of the ray Vauquelin obtained an oil which constituted more than half the weight of the organ.

\* Anatomie Descriptive, t. ii., p. 567.

The liver is enveloped by two *tunics*, which, although they are intimately connected, differ from each other widely in their structure, and in the purposes which they are destined to fulfil in the animal economy. Of these, the external, after covering the greater part of the surface of the organ, forms a number of folds, improperly called ligaments, which unite it to the diaphragm and wall of the abdomen. Derived from the peritonæum, it is perfectly transparent, smooth, and lubricated, for allowing the liver to move, without detriment, upon the surrounding parts. No vessels can be discerned in it in the healthy state; and, when diseased, it often adheres to the neighboring structures by bands of adventitious cellular tissue.

The other membrane, usually named the *proper coat*, is much the more important of the two, inasmuch as it may be considered as constituting the framework of the entire organ. Not only does it enclose and sustain the liver, but it sends thousands of processes into its interior, which, intersecting each other in every conceivable direction, form so many minute capsules for the hepatic granules. Thus, each of these little bodies may be viewed in the light of a representative of the entire gland, as it is not only furnished, as already stated, with appropriate vessels and nerves, but likewise with its own proper covering.

In structure, this tunic assimilates itself to the fibrous membranes. It is by no means so close and thick as the pericardium, with which, however, it has many important characters in common. Thus, for example, it is composed of fibres which interlace in different directions, and is in contact on one side with a serous membrane, which, in both cases, answers a similar purpose, that, namely, of facilitating the movements of the respective organs. Nor does the analogy cease here. In inflammation of the fibrous coat of the liver, the disease is generally propagated to the parenchymatous structure, in virtue of the processes which the membrane sends into the interior of the organ, and also of its close connection with its outer surface, in the same manner as an inflammation of the pericardium may be propagated to the muscular substance of the heart along its serous investment.

Much difficulty is experienced, and much dexterity required, in dissecting this membrane from the parts with which it lies in contact. On the concave surface of the liver, it is almost impossible to display it; but, anteriorly, and especially towards the upper margin, it is very easy to raise it in the form of a strong, thick, dense, and consistent coat, inelastic, and of a light greyish color. In a preparation in my private collection the membrane is nearly the twelfth of an inch in thickness. Superiorly it runs into the cellular tissue which is so abundantly found at the upper border of the liver, and which serves the purpose of uniting the organ with the diaphragm. The mode of this connection should not be lost sight of in our pathological investigations. Since it enables us to explain the manner in which disease may be propagated from one of these structures to the other, and how the matter of an abscess, originally formed in the liver, may find its way into the lungs, and be finally expelled by coughing.

A knowledge of the *situation* of the liver, in respect to the neighboring parts, is of no little importance in reference to the diagnosis of some of its structural lesions. Such information will also be in the highest degree useful, as enabling us to comprehend how an enlarged liver may compress the stomach and interrupt its functions; how it may produce jaundice, by impeding the flow of bile; dropsy of the abdomen, by obstructing the return of the blood to the heart; how abscesses, originally formed in the hepatic tissue, may burst into the surrounding organs.

The position of the liver is sometimes singularly altered, even although it may not have undergone any change in bulk. Thus, in hydro-thorax, it may be prominently felt, not only in the epigastric, where a part of it is naturally situated, but also in the umbilical and left hypochondriac regions. On the other hand, in copious ascitic effusions it may be forced so high up into the chest as to encroach seriously upon the right lung, producing atrophy of that viscus, and terrible dyspnea. Sometimes, again, the liver is pushed over into the left hypochondriac region, by an encysted tumor, or by enlargement of the right kidney. Now all these facts should be borne in mind by the physician, as they have an important relation to the diagnosis of abdominal diseases.

The *lesions*, which will be treated of in the present chapter, are, inflammation, suppuration, gangrene, softening, induration, hypertrophy and atrophy, tubercles, cancer, melanosis, hydatids, adipous degeneration, worms, cartilaginous and osseous concretions, apoplexy, erectile tumors, and laceration.

*Inflammation* of the liver may involve either its proper substance or its investing membranes, and, like the same disease in other organs of the body, it may be either acute or chronic. The acute form of the complaint is of rare occurrence in this country, but is sufficiently frequent in hot climates. In warm latitudes, there is always, as is well known, a high degree of nervous excitability of the chylopoietic viscera, and hence nothing is more common than to see a large proportion of the maladies of those regions characterized by a predominance of inflammation of the stomach, liver, bowels, or spleen. In our Southern States, almost all diseases assume a bilious type; but whether the liver labors under much inflammatory irritation, or is merely sympathetically affected, are points which still remain undetermined. The term *congestive*, which is so much in vogue with the physicians of those regions, seems to me to be often used unmeaningly, certainly without a proper regard to the fundamental principles of pathology. It is with them a sort of talisman, — a mantle which covers a multitude of sins in the way of unsuccessful practice. That the internal organs, and especially the liver and spleen, are often inundated with blood in the intermittent and bilious fevers of those districts, may be readily supposed; but that this condition can last long without inflammation, is what very few will be willing to concede.

Inflammation of the liver appears occasionally to assume an epidemic type, affecting a considerable number of persons at the same time. An instance of this tendency occurred in 1828, in the city of Dublin, where, as we are informed by Professor Stokes, prior to this period, acute hepatitis was looked upon as a very rare disease, — a case being seldom met with more than once in a year or two, in their largest hospitals. At the date here specified, however, every institution of the kind in the Irish metropolis had a considerable number of individuals afflicted with it, and of these not a few died.

The anatomical characters of *acute hepatitis* vary, as might be expected, according to the intensity of the irritative action, and the length of time it has been in operation. In general, the first perceptible effect is an increase of the vascularity of the parenchymatous structure, which becomes engorged in circumscribed spots, of a light red color. The part affected is somewhat tumid, abnormally dense, and bleeds freely on being incised: the hepatic canals are distended with a viscid, yellow, brownish fluid; and the acini are increased in size, and of a florid tint, though sometimes the reverse is the case, these bodies being much less distinct than natural.

In a more advanced stage, in addition to the vascularity, the hepatic structure becomes singularly softened, so that it may be reduced, by the slightest pressure of the finger, to a mere pulraceous mass. This state is analogous to



the second stage of acute pneumonitis, and, like it, may be accompanied by the formation of pus, or a deposition of lymph upon the serous surface. In this respect, however, there is a wide difference between the liver and the lung, as we seldom meet with inflammation of the substance of the latter without pleuritis, while the reverse often obtains in acute hepatitis.

In its transition from the first to the second stage, the inflammation often gives rise to various shades of color. Thus, the parenchyma may be of a deep red, disposed in arborescent lines; or the vessels may encircle the acini in the form of wreaths, which freely anastomose with each other. When the disease is very intense, it is not unusual to see a number of small ecchymoses, produced by a rupture of some of the capillary arteries or veins; and instances frequently occur in which the affected part assumes a deep brownish, violet, or mottled aspect, the latter appearance being particularly liable to happen when the inflammation occurs in circumscribed spots. In such cases, the whole portal circle is gorged with black blood, the biliary ducts are deeply injected, and their contents, being of a sero-sanguinolent nature, have no longer that bitter taste and ropy feel which characterize healthy bile. The mucous coat of the duodenum, also, is more or less phlogosed, and the minute branches of the hepatic artery and portal vein no longer admit injecting matter.

It is not often that the whole of the liver is involved in acute inflammation: most commonly it is limited to its surfaces, its borders, or some of its deep-seated parts. In the latter case, the disease sometimes escapes the attention of the examiner, owing to the normal aspect of the exterior of the organ. Hence the necessity, in all our investigations, after having tied the large vessels, of removing the liver from the abdomen, and cutting it into thin slices. In some cases, especially such as follow surgical operations, the hepatic and portal veins are inflamed; and instances occasionally occur in which these tubes are filled with purulent matter.

When the inflammation is seated in the investing membranes, they exhibit the same appearances as the fibro-serous textures generally. Numerous vessels pervade them, passing up from the parenchymatous texture, and they are thicker and more opaque than in the healthy state. Lymph is also commonly deposited upon their outer surface, either in narrow bands, in small patches, or in considerable masses. The organ being thus glued to the neighboring parts, is often compressed, and much restrained in its movements. In some instances it is literally buried in lymph, and so strong are its adhesions, that much dissection is required before it can be liberated. The disease, however, is seldom thus extensive: in the generality of cases, it is limited; and, if I may judge from my own observations, it has a peculiar predilection for the anterior segment of the membranes.

Does disease of the substance of the liver ever exist without involving its coverings, and, conversely, of its coverings without involving its substance? Upon this point, different opinions have been expressed by different writers; some answering affirmatively, others negatively. M. Bonnet, a recent French writer, maintains that inflammation of the hepatic parenchyma is almost always accompanied with inflammation of its peritonæal investment. The arguments, however, by which he endeavors to sustain his proposition have a very slender foundation; and, as they are directly at variance with the testimony of some of the best authorities of the present day, no further notice need be taken of them here. The dissections of Annesley, Andral, and Louis, are sufficient to negative a thousand speculative notions; and, if any reliance is to be placed upon them, it is clear enough that the very reverse of the posi-

tion assumed by M. Bonnet is the true one. Not only do these pathologists assert that hepatic peritonitis is of extreme rarity, but they declare, upon the evidence of repeated personal observation, that the substance of the organ may be greatly altered, nay, even seriously disorganized, and yet its tunics be perfectly sound. "Even abscesses of the liver," says Mr. Annesley, "may proceed to the utmost extent, and ultimately break into the abdominal cavity, without having induced inflammation of the serous surface, where they point, and consequently without forming adhesions to the parts with which they are in immediate and close contact."

Not much need be said here of the *symptoms* of acute hepatitis, as all the information the student may desire upon this point can be obtained in our common treatises on medicine. The local phenomena, to which my remarks will be limited, may be referred principally to the pain, tenderness, and swelling in the region of the affected organ. When the disease is seated in the parenchymatous structure the pain is of a dull, heavy, aching character; if in the investing membranes, it is sharp, lancinating, and often extremely severe. In either case, but especially in the latter, it is constantly increased by pressure, by inspiration, and by coughing. In some instances, the pain is felt in the right shoulder, along the spinal column, under the short ribs, in the loins, or in the epigastric region; but, as these symptoms may arise from other affections, as, for example, inflammation of the top of the right lung, incipient phthisis, pleuritis, aneurism of the right subclavian, gastritis, colonitis, or disorder of the kidney, they are worthless as diagnostics. The patient lies commonly on the affected side, seldom on the back or on the left side; in which respect there is a striking difference between this disease and acute pleuritis, in which the person always lies on the sound side.

The tumefaction of the liver, which, next to the pain and tenderness, may be regarded as the most important symptom, is seldom considerable. When it is, the right hypochondriac region appears unnaturally full, and the margin of the organ can be felt beneath the edges of the false ribs. In some instances, the costal cartilages seem to be tilted out; but, in such cases, the intercostal spaces almost invariably retain their depressed appearance; affording thus a striking contrast between hepatic and pulmonic disease, in the latter of which, when the cavity is distended, the intercostal spaces are either flat, or pushed beyond the level of the ribs. Such, then, are the three signs upon which our principal reliance is to be placed, when endeavoring to make up our diagnosis of acute hepatitis, *pain, tenderness on pressure, and swelling*. Add to these, the position which the patient assumes in bed, the derangement of the digestive organs, and the inflammatory state of the system, and little or no difficulty can occur in coming to a correct decision.

Acute inflammation may terminate by resolution, the formation of matter, gangrene, or softening of the hepatic texture. Not unfrequently it passes into the chronic form, when it is liable to give rise to induration and other structural lesions. There is reason to believe that chronic hepatitis sometimes exists as a primitive affection; its invasion being very gradual, and unaccompanied by any severe symptoms. It is a much more frequent complaint, in this country, than the acute form; yet it is not quite so common, perhaps, as the term "liver disease," so generally used by the profession, would lead us to suppose. The anatomical characters of the disease, together with its diagnostic symptoms, so far as they are understood, may be collected from what we shall say concerning induration, hypertrophy, atrophy, and fatty degeneration of this organ.

Although *suppuration* of the liver occasionally follows chronic inflammation,

yet this effect is much more frequently witnessed as the result of the acute variety of the disease. The pus may be diffused, occur in small points, or be collected into one or more abscesses. The number of these purulent deposits is often quite great, the liver being literally burrowed by them; sometimes they communicate together by narrow fistulous passages, but in most cases they are separated by considerable intervals, or by thin partitions of hepatic substance. Occasionally the abscess is of extraordinary size, occupying nearly the whole of one lobe, or the greater part of the organ. In this way quarts of matter are sometimes accumulated, and the hepatic textures almost entirely wasted. When the quantity of fluid is great, or if it be long detained, even when small, it is apt to become encysted, the membrane by which it is enclosed, and which is susceptible of organization, varying in thickness from the fourth of a line to half an inch, and in consistence from the softness of lymph to the firmness of fibro-cartilage. In other cases, especially in such as run a very rapid course, the matter lies in immediate contact with the hepatic tissue, which is itself usually in a state of purulent infiltration, or very much softened and altered in color.

The matter of a hepatic abscess usually partakes a good deal of the nature of true pus, being of a thick, white, cream-like appearance. Sometimes it is thin and sanious, sometimes thick and curdy, sometimes thin and brownish, like chocolate, and sometimes of the color and consistence of a decoction of unburnt coffee. In the generality of cases, it is destitute of smell; but occasionally it is highly offensive and irritating. Now and then the fluid contains flakes of blood of a dark grey color; and instances occur in which it looks like the washings of flesh.

Suppuration of the liver does not always prove fatal. In many instances the matter has a tendency to discharge itself externally, or to force its way into some one of the adjacent organs. The principal circumstances which appear to influence the point of communication are the seat of the abscess and the general volume of the hepatic tumor. In the abdomen, the opening usually takes place in the peritonæal sac, the colon, duodenum, the stomach or gall-bladder: when the abscess points externally, the matter may find its way out at the epigastric region, the right loin, or between the false ribs; and in either case it generally pursues a narrow, fistulous route. It is not improbable that the pus, formed in the substance of the liver, may sometimes pass into the bowels through the biliary ducts; and authors mention instances in which it found an outlet through the right kidney. When the abscess is seated at the upper border or on the convex surface of the liver, it not unfrequently breaks into the right side of the chest, where it either excites fatal inflammation, or erodes the pulmonary tissue, and is finally discharged through the bronchial tubes, between the ribs, or even through the axilla. In one instance the matter was discharged into the vena cava. But the most extraordinary circumstance connected with this subject is, that the fluid sometimes works its way into the pericardium. Of this an interesting case has been reported by Mr Knott, of India, and another by Professor N. R. Smith, of Baltimore. In the latter the liver adhered closely to the upper part of the diaphragm, and was occupied by an enormous quantity of pus, about a quart of which had escaped into the pericardium. In a case detailed by Dr. Graves,\* of Dublin, the abscess opened both into the pericardium and the stomach. When the matter is discharged, the abscess sometimes heals, the process being analogous to that which is observed under like circumstances in the lungs and other organs.

\* Dublin Medical Journal, January, 1839.



Hepatic abscesses, on the whole, I have reason to believe, are very rare in this country, having never, in all my dissections, seen more than two cases.

In Europe, they are also extremely infrequent;\* but they are sufficiently common in hot climates, and no where, perhaps, more so than in the East Indies.

In acute hepatitis, pus usually begins to be deposited in the course of six or eight days from the commencement of the attack; whereas, in chronic cases, months often elapse before the occurrence of this event. When suppuration is about to take place, there is a sudden aggravation of all the symptoms; the patient experiences frequent rigors, followed by profuse sweats: the pain in the side is of a throbbing, lancinating nature; and there is a peculiar sense of sinking, with anxiety and precordial oppression; the organ is commonly somewhat enlarged; and although there is no distinct fluctuation, especially if the matter be deep-seated, there is almost always a boggy, yielding sensation imparted to the finger when passed over the region of the tumor. This sensation, as might be anticipated, will be more distinct in proportion as the purulent fluid approaches the surface; and in this case, too, the diagnosis will be much aided by percussion. In the natural state, the hepatic tissue is so dense as to afford a very dull sound when we strike the hypochondriac region; but in superficial abscesses, especially in such as do not contain too thick and consistent a pus, there is usually a considerable degree of resonance, which serves to define the limits between the healthy and diseased parts. After all, however, the nature of the lesion is often extremely obscure, and it may be truly said that there are few occasions for finer diagnosis than in the affection in question.

Abscesses of the liver are liable to be produced by irritation of the lungs; and in many instances they supervene upon injuries of the head, large wounds, and surgical operations. The matter in these cases is supposed by some to be transmitted with the blood through the veins, from remote and diseased parts: but the more philosophical opinion, and that which meets my own approbation, ascribes its origin to inflammatory irritation of the substance of the liver, brought on by some inscrutable sympathetic action. That matter may be thus conveyed, is probable; but that it should create irritation in one organ in preference to another, is a point in pathology which cannot be very easily comprehended. If it has any truth at all, it forms merely an exception to the general rule. To admit that abscesses may be thus produced in any organ, is to admit that such an organ has an elective attraction for the purulent fluid that shall be flowing in the circulating mass; or, on the other hand, that its tissues are so close and peculiar, its capillaries so exceedingly fine, as to entangle the matter, and retain it forcibly in its interior. To me the hypothesis appears not only objectionable, but too absurd almost for serious consideration.

The mode of development of these *metastatic abscesses*, as they are denominated, is remarkably insidious, and they are frequently connected with jaundice and phlebitis. Usually not larger than a hemp-seed, a pea, or a filbert, they are of an irregularly rounded shape, and much less perfectly circumscribed than when they are seated in the lungs. They may occupy any portion of the liver, but in most cases they are situated superficially; their number varies from one to several dozens, and their contents, which are commonly of a reddish, yellowish, or greenish color, are of a semi-concrete consistence, like that of a mass of fibrin. The hepatic tissue around these abscesses may be unaltered; but in general it is softened and preternaturally vascular. When seated superficially the peritonæal covering is apt to participate in the morbid action. Commonly they succeed the original lesion on the tenth or twelfth days.

The termination of acute hepatitis by *gangrene* is so rare, that many writers

\* Andral's Pathological Anatomy, vol. ii., p. 373.

have denied the possibility of its occurrence. Baillie never witnessed an instance of it,\* and Annesley, although for many years an inter-tropical practitioner, and constantly in the habit of making examinations, declares he has not been more successful.† In several thousand dissections made by Andral,‡ this lesion occurred only in a single case. From all these facts, it may be justly concluded that gangrene of the liver is of great rarity. Portal describes the mortified part as being extremely offensive, of a dark color, pervaded with sanious fluid, very soft and lacerable. In a case recently detailed by Dr. Stokes, of Dublin, the organ bore numerous marks of chronic disease, and in the left lobe was a cavity which was distinctly gangrenous, having in its centre a large mass of slough. The patient, an old drunkard, complained, during the last few days of his life, of great pain and tenderness of the abdomen; and, a short time before he expired, he was seized with vomiting, and threw up a large quantity of fetid matter.

*Softening* of the liver is a common and destructive affection in warm latitudes; but is very rare in the more temperate regions of America and Europe. That this is the case I am disposed to believe from my own experience, and from the few cases that are reported of this disease in our periodicals. The softening may present itself under two distinct forms, differing from each other both in their color and consistence, but resulting probably from the same cause, namely, inflammatory irritation. In the more common variety, which I shall denominate *brownish softening*, the substance of the organ usually retains its normal color, but is broken down and friable, or has so far lost its cohesive properties that it readily yields to the force of the finger. In some instances, the affected part is infiltrated with thin, bloody, sanious, or puriform matter, and is converted into a soft, brittle mass, not unlike a rotten pear. When put in water, an immense number of small granules appear, resembling the seeds of a bunch of dried grapes: they are of a yellowish, brownish, or cinnamon color, and are attached to the large vessels by delicate vascular pedicles. In other cases, maceration produces an appearance like the washings of half-putrid flesh, the water becoming discolored, and the part exhibiting multitudes of shreds, the remains, probably, of vessels and fibrous filaments. This variety of mollescence is generally most remarkable on the convex surface of the liver, and occurs almost always in combination with disease of the other viscera, especially of the stomach, spleen, and lungs. According to Mr. Annesley, it is frequently met with in India, in persons who are rapidly carried off by cholera, dysentery, and malignant fevers.

The *second species* of softening has received the name of *black*, and, from its close resemblance to gangrene, is probably the result of a higher grade of inflammatory action, disorganizing the parenchymatous texture. It commonly invades a large extent of surface, sometimes, indeed, almost the whole organ, which it reduces to a dark pultaceous mass, having the consistence and aspect of grumous blood, or of a black, softened spleen. In some instances, the affected part emits a remarkably fetid odor; a circumstance which, together with its color, has given rise to the belief that the disease is analogous to, if not identical with, gangrene. The size of the liver is commonly diminished; it may, however, be perfectly natural, and occasionally it is considerably augmented.

Very often there are no symptoms which denote the existence of this fatal

\* Morbid Anatomy, p. 136.

† Diseases of India, vol. i., p. 435.

‡ Pathological Anatomy, vol. ii.

lesion during life. In a case recently communicated by Professor Lee, of New York, in which the liver was completely disorganized, and converted into a black mass, like grumous blood, the patient, a colored man, of intemperate habits, forty years old, suffered no other inconvenience than diarrhœa and slight debility; he was not confined to his house, and suddenly expired while walking the street.\* In another case, mentioned by Dr. Abercrombie,† the symptoms were jaundice, want of appetite, and nausea, followed, towards the last, by vomiting of black matter: there was no pain, no tenderness, no fulness in the region of the liver. From these and various other facts of a like character, it may be inferred that the disease, commencing in the parenchymatous structure of the organ, progresses in a stealthy and insidious manner in its work of disorganization, without always particularly impairing the general health.

Neither Morgagni, Haller, nor Baillie seem to have ever met with this disease; and, although numerous examples have been narrated by more recent writers, a good description of its anatomical characters is still a desideratum. The causes of this singular lesion are not well understood; but that it depends upon inflammation, either acute or chronic, is an opinion which seems to be borne out by an attentive examination of the various cases of it which are to be found upon record.

There is a state of the liver, not at all unusual, the very reverse of that which has been now described. I need scarcely say that I refer to *induration*. In this disease, the substance of the organ is unnaturally hard, firm, and dense, exhibiting, when torn, a singularly granulated surface. The volume of the gland may be unaltered, but in most cases it is much reduced, occasionally nearly one-half. The color varies in different instances, from a pale red, to purple, nutmeg, brown, or lilac. Cruveilhier states that he has often seen induration of the liver accompanied with a green olive hue; but of this I have never witnessed an instance, nor am I aware that the same observation has been made by other pathologists. This change, which commonly results from chronic inflammation, is often characterized by great thickening of the fibrous structure, and by remarkable atrophy of the hepatic granules. In some cases, indeed, the granules seem to be entirely removed, their place being occupied by cellular tissue, very hard, and of a dull greyish color. The tunics of the liver usually participate in the condensation; the cellular substance accompanying the ramifications of the hepatic artery and portal vein is frequently indurated; and many of the excretory ducts are permanently obliterated, whilst others are thickened, and of almost gristly consistence.

The induration is not always partial: I have frequently seen it pervade the entire organ, though in the majority of cases it occurs in patches, or is limited to particular parts. The right lobe and lobule of Spigelius are perhaps more generally implicated than any other portions. The disease is often attended with pain in the hypochondriac region; the countenance is wan and sallow; the conjunctiva is more or less yellow; and the patient is liable to be affected with ascites. The secretion of bile is frequently very sparingly performed, and the properties of this fluid are singularly altered. These symptoms, however, are far from being constant; nor can they be considered, when present, as diagnostic of hepatic induration.

*Hypertrophy* of the liver is a frequent affection. It is said occasionally to exist alone, but this is doubtful. In by far the greater number of cases, if indeed

\* American Journal of the Medical Sciences, vol. xvii., p. 60.

† Pathological and Practical Researches, p. 357.



not all, it is combined with induration or softening. The color, size, and form of the liver in this affection vary infinitely, according to the period of its existence and the nature of the primary lesion. The most common tints are pale red, grey, brownish, dark green, mahogany, and nutmeg. Frequently these colors are more or less blended, so as to impart a variegated appearance to the parenchymatous structure.

The bulk of the organ is sometimes enormous. Cases have been recorded in which the human liver weighed from twenty to thirty pounds; and in animals, as the horse and ox, the weight not unfrequently exceeds one hundred pounds. In the case of a woman of thirty-three, mentioned by Dr. Ruyer, in the *Encyclographie des Sciences Médicales* for 1835, the organ weighed twenty-four pounds.\* It was of a brownish slate color, soft and friable, and filled the whole abdominal cavity, forcing the diaphragm high up into the thorax, and pressing the bowels and other viscera firmly against the spinal column. Its substance contained numerous whitish tumors, varying in size from that of a mustard-seed to that of a hen's egg, and some of which were occupied by purulent fluid.

The hypertrophy may be limited to a single lobe, or it may occur in all of them at the same time; most commonly, however, it attacks the right side. The shape of the liver may be variously affected; and the surface of the organ is frequently very rough, granulated, furrowed, notched, or mammillated.

Hypertrophy is most common in young strumous subjects, or in those whose constitution has been tainted by syphilis, and is usually connected with a low and protracted inflammatory state of the parenchymatous structure. The affection is rarely attended with much inconvenience, save what arises from the increased bulk of the organ. In the generality of instances, there are jaundice, dropsy of the abdomen, irritable stomach, and constipation of the bowels, with enlargement of the spleen, and a sense of weight in the right hypochondriac region.

*Atrophy* of the liver is much less frequent than hypertrophy, and usually occurs in union with induration or mollescence. I have seen it repeatedly affect the whole organ; it is much more common, however, to find it limited to one of its lobes, and, what is rather paradoxical, the liver may not only be of its natural dimensions, but even enlarged. In speaking of induration, mention was made of the fact that the granular structure is sometimes entirely absorbed and replaced by dense cellular substance. In this case, although there may be no diminution of bulk, there is yet an actual wasting of the hepatic tissue, the part affected being reduced, as it were, to its primordial framework. The color of an atrophied liver presents every variety of shade, from greyish-white to almost entire black.

This state of the liver is often observed in persons who are in the constant habit of using ardent spirits. It is rarely seen before the middle term of life, and is most common in old age. The hepatic vessels are always much diminished in size, and the functions of the organ more or less impaired. Its cause is manifestly chronic inflammation, producing an effusion of lymph and a partial absorption of the granular tissue. The atrophy is frequently connected with ascites, either as cause or effect.

As intimately connected with the two changes last described, it will be proper here to notice that peculiar state of the liver to which some of the French

\* "Mr. Gooch gives a case in which, during dropsy, the liver acquired the monstrous weight of twenty-eight pounds. Baldinger reports another instance, in which it reached twenty pounds; and Bonetus a third, in which it weighed only two pounds less."

and British pathologists have applied the epithets *granulated*, *mammillated*, and *tuberculated*. (Fig. 170.) The affection seems to have first attracted the attention of Laennec, who has described it under the name of *cirrhosis*, in reference to the tawny yellow color which it occasionally presents. It was soon after noticed by Dr. Baillie, of London; and, since his time, it has been particularly investigated by Andral, Bouillaud, Cruveilhier, Hope, Carswell, Becquerel, and other anatomists. The lesion seems to consist essentially in a deposition of albumino-fibrinous matter, caused by protracted inflammatory irritation, and fol-

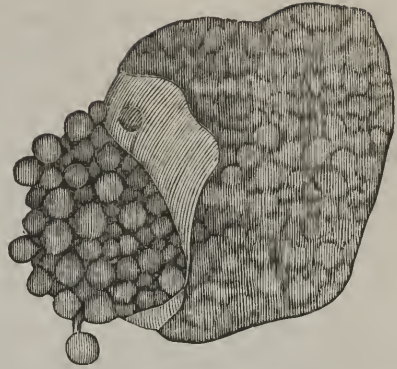


Fig. 170.

lowed by hypertrophy of some of the granulations with atrophy of the others, and a preternatural development of the cellulo-fibrous element of the organ. The texture of the granulations is dense and compact, and exhibits a great variety of tints, being sometimes of a deep brownish red, sometimes of a tawny yellow, like bees-wax, and not unfrequently of a pale cinnamon, pink, or lilac hue. When cut, they present a perfectly flat surface; and, if further examined, are found to be invested by a dense cellulo-fibrous capsule, of a light greyish color, from which they can be easily removed by dissection, their principal bond of connection being a small pedicle, through which they receive their supply of blood-vessels, nerves, and absorbents. The size of the granulations is extremely variable, even in the same liver. In general, they do not exceed a garden pea, and frequently they are not larger than a currant or a hempseed. In a case which I examined recently at the Louisville Marine Hospital along with Dr. Colescott and Mr. Pyles, the resident physician, many of the granulations were as big as a hazelnut. The liver weighed five pounds and a half. In their shape these bodies are mostly spherical, or irregularly rounded; not a few, however, have a compressed, flattened, or angular appearance.

When these granules are very numerous, not large, and of a variegated brownish color, they give the liver a peculiar *nutmeg-like* appearance. (Fig. 171.) This state of the organ is most prevalent in old dram-drinkers; but it may also result from repeated attacks of chronic irritation, or from long-continued congestion. Hence obstruction of the vena cava or hepatic veins seldom exists long without producing enlargement of this kind.

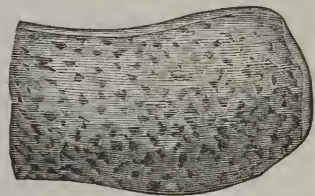


Fig. 171.

In whatever form this species of hypertrophy occurs, the surface of the liver generally presents a singularly mammillated aspect, as if it were raised into a multitude of spherical eminences; the peritonæal coat is thickened, opaque, and wrinkled; and the volume of the organ is either diminished or augmented, seldom natural. In the former case, the hepatic texture is generally very dense, and almost destitute of moisture; in the latter, it is usually somewhat soft, more or less vascular, and impregnated with thin, bloody matter, which can be easily squeezed out with the fingers. In both varieties, but more especially in the first, the hepatic tissue is often of a yellow tinge; and the bile being retained in the rootlets of the hepatic duct, exudes pretty freely on making sec-

tions of it. If, in this state, a portion of liver be macerated for ten or twelve days in water, the little granules will assume the appearance of adipocire, and may be easily washed out of their cellulo-fibrous capsules, leaving them in a soft, flocculent condition. In the advanced stages of cirrhosis, especially when there is great diminution with contraction of the liver, many of the vessels and ducts are obliterated, and the tissue of the organ becomes difficult of injection. Occasionally a collateral venous circulation is established by way of the diaphragm. Mr. Wilson\* mentions a case of this kind: the hepatic circulation had been impeded by the development of condensed cellular tissue, and the greater part of the blood of the portal vein had passed through dilated vessels upon the surface of the liver to the diaphragm, and from thence into the general venous circulation. The organ was reduced to one-half its natural size, and had contracted extensive adhesions with the diaphragm, intestines, and walls of the abdomen.

Respecting the intimate nature of cirrhosis, the opinions of pathologists are strikingly conflicting. Laennec,† who first described it, considers it as a special accidental tissue, a new formation, deposited in a state of crudity, and undergoing ultimately a process of softening, not unlike the matter of tubercle. He imagines that it may be also developed in other organs of the body, and he speaks of it as occurring under three varieties of form, the tuberoid, patch-like, and encysted. Andral,‡ on the other hand, views cirrhosis merely as atrophy of the red substance, with hypertrophy of the yellow; a conjecture founded, it will be perceived, upon the supposed existence of two distinct classes of granulations. A similar opinion has been expressed by Cruveilhier.§ According to Bouillaud,|| the lesion is a disunion of the two natural elements of the liver, the yellow acini being nothing more than the secreting lobules, which are gradually disorganized by the vascular tissue, and the consequent obstruction of the hepatic circulation. Dr. Carswell,¶ who has given a short but very graphic account of this affection, states that it essentially consists in atrophy of the lobular structure, produced by the pressure of the contractile fibrous substance formed by the capsule of Glisson. Finally, Becquerel,\*\* the latest authority upon the subject, asserts that cirrhosis is seated in the vascular tissue of the liver, and that it consists of an interstitial infiltration of a yellowish plastic matter, coagulable by heat, and possessing all the properties which characterize fibrin and albumen. He considers that this effused substance is analogous to the false membranes of the serous and mucous textures, and that it is liable to the same changes and transformations, becoming harder and firmer with the progress of age. "From the contraction of this matter the yellow substance of the liver which was at first hypertrophied becomes atrophied, the altered lobules are diminished in volume, and many of them often coalesce, forming the patches which were described by Laennec as occurring in certain forms of this disease, and which give an irregular appearance to the surface or to a section of the liver. When this retraction has taken place, a great portion of the red or interlobular tissue of the liver no longer exists, and we only see an irregular agglomeration of yellow tubercles of different sizes, and the whole organ becomes hardened and shrivelled."

\* Cyclop. Anatomy and Physiology, vol. ii., p. 189.

† Dictionnaire de Médecine, art. Foie.

‡ Pathological Anatomy, by Townsend, vol. ii., p. 367.

§ Anatomie Pathologique, livraison xii.

|| Memoire de la Société Médicale d'Emulation, t. ix., p. 179.

¶ Pathological Anatomy, art. Atrophy.

\*\* Brit. and Foreign Medical Rev., vol. x., p. 561.



Such is a very succinct account of the principal theories upon the subject under consideration. My own opinion, founded upon careful and repeated examination, is, that this lesion consists in a deposition of albumino-fibrinous matter in the parenchymatous texture, leading to hypertrophy of some of the granulations and to atrophy of the others, with an unusual development of the cellulo-fibrous tissue, and marked diminution, or even total obliteration of the caliber of many of the smaller vessels. It is, in fact, a sort of hepatization, analogous to that of the lungs and spleen, the result of protracted irritation attended with congestion of the hepatic circulation and partial retention of the biliary secretion. The probability is, that all the granulations originally participate in the morbid change, but that during the progress of the disease some of them are greatly compressed, by which their nervous and vascular supply is greatly diminished, if not wholly cut off, while the others which escape this constriction, instead of becoming wasted, gradually assumes the condition which we have described. What favors this view of the subject is that the hypertrophied acini are all furnished with separate footstalks, which are easily demonstrated by the knife, and which serve to convey to them the vessels, nerves and lymphatics, which exist in them in the natural state, and which are now more or less enlarged. The atrophied acini, on the contrary, have no such provision, or, at all events, only a very slight and imperfect one; as the disease advances their vessels are obliterated, and their whole substance finally disappears.

The above, it seems to me, is as plausible a view of the nature of cirrhosis as can be offered in the existing state of the science. Whether it is correct in all its parts, further investigation will alone be able to determine. The explanation of Andral and Bouillaud is altogether unfounded, since it assumes the existence of two varieties of granulations, which, it is well known, is not the case; the theory of Cruveilhier and Carswell is only partially true; that of Laennec is entirely erroneous; and the doctrine lately advanced by Becquerel is partly correct, partly hypothetical; it is true as it respects the nature of the deposition, erroneous as it respects the location of it.

Cirrhosis appears to be more frequent in the male than in the female sex. Of forty-five cases examined by Becquerel, twenty-eight occurred in men and seventeen in women. The disease, although occasionally met with in children and young persons, is most common between the thirtieth and fiftieth years. I have several times seen it in very old subjects.

This malady of the liver rarely exists by itself, but is almost constantly complicated with organic disease of other parts of the body, particularly of the heart, kidneys, and lungs. Becquerel found only seven out of forty-two cases which he could consider as perfectly simple. The most common complication is chronic lesion of the heart, which was present in one-half of the cases examined by this pathologist, and which had advanced to such a degree as to render it probable that it had preceded, if not actually given rise to, the disease of the liver. The morbid alteration of the kidney, known by the name of Bright's disease, was met with fifteen times, or in nearly two-thirds of the patients. Cirrhosis very rarely exists in connection with tubercles of the lungs. The fatty degeneration of the liver, on the contrary, is a frequent complication of consumption. In the latter stages of the disease there is almost invariably ascites with anasarca, oedema of the lungs, hydrothorax, pericarditis, purulent effusion into the peritonæal cavity, pneumonia, pulmonary apoplexy, or intestinal hemorrhage.\* Occasionally several of these complications coexist. In some instances the disease is accompanied by jaundice.

\* Becquerel, *British and Foreign Medical Review*, vol. x., p. 563.

The liver has occasionally a peculiar *adipous* appearance, the fatty matter being either diffused through its parenchymatous structure, or confined to particular spots. The affected part is of a pale yellowish color, not unlike that of a pale autumnal leaf; its consistence is more or less diminished; it perceptibly greases the scalpel, is unctuous to the touch, and yields an oily principle by boiling. This, according to the recent experiments of Mr. Bird, of London, is a soft, brownish substance, very fusible, and possessing a peculiar and pleasant odor. The quantity yielded by a pound of hepatic tissue is about five drachms and a half. Vauquelin found in 100 parts of fatty liver 45 parts of oil, 19 of parenchyma, and 36 of water.

Frequently the surface of the organ presents small brownish spots, which, from the manner in which they are arranged, give it a very singularly mottled appearance, resembling very much the liver of the shark, cod, and other oily fishes. When a section is made, the interior is found to be of a much more uniform color, being of a pale yellow, deep orange, or light ochre. The hepatic tissue is generally if not always diminished in specific gravity. In two specimens examined by Mr. Bird, the weight was only 1,027, whereas in the same amount of healthy liver it was 1,062. The hepatic vessels in this affection, though apparently compressed and scarcely perceptible, retain their natural structure. They are all permeable, and may be easily traced to the minute parts. The branches of the portal vein are filled with black blood, and the excretory ducts contain unusually dark and fluid bile. If a section of a liver thus affected be examined with the microscope, it appears, according to Dr. Albers,\* of Bonn, like a pale white, spongy substance, containing separate cells of a bright color, with a delicate fluid, and here and there a dark, brown acinus, which is smaller than in the normal state. The lobules themselves are atrophied, but the intervening cellular substance is abundant and hypertrophied. Albers supposes that this tissue is the principal, if not the exclusive, seat of the fatty deposit; while Mr. Bowman,† of London, infers that it is the *nucleated particles*, as he terms them, of the hepatic lobules, which naturally contain two or more globules of oily fluid, irregularly arranged, and of variable bulk. In the affection in question these little bodies are gorged with large masses of this substance, which greatly augment their volume, and more or less obscure their internal structure. Whether these conjectures are well founded remains to be determined.

This fatty degeneration occurs almost exclusively in drunkards and phthisical subjects. Louis found it in forty-four persons out of the one hundred and twenty-three who died of the latter disease under his care, in the Charity Hospital at Paris. This writer even goes so far as to contend that this state of the liver is never seen, except in connection with tubercles of the lungs, or of some other organs. That this, however, is not necessarily, although it may be generally, the case, is abundantly disproved by the observations of other pathologists.

Various hypotheses have been offered with a view of accounting for this curious state of the liver; but the only explanation which seems to me to be at all tenable, is that which ascribes it to chronic inflammation, with venous engorgement, giving rise to an augmentation of the secretion of fatty matter, which, according to the well-known experiments of Braconnot and Vauquelin, is naturally contained in the organ. This opinion derives support and illustration from what is observed in the inferior animals. In the goose and duck, an almost complete *adipous* transformation of the liver may be induced in a few

\* British and Foreign Med. Rev., vol. viii., p. 555.

† Lancet, for January, 1842.

weeks, simply by subjecting them to inactivity, withholding the light, and cramming their stomachs with a paste made of barley-meal, mutton-suet, and coarse sugar, mixed with milk. This mode of fattening fowls has been pursued for many years in the neighborhood of London, and it has been found that if the repletion be kept up longer than a fortnight, so much structural lesion will be induced as to kill them, or render the meat unfit for the table, the liver being converted into a soft, red, oily mass. In the human subject, this change seems to take place very rapidly in some instances, as in the course of five or six weeks; and the organ is not unfrequently double the usual weight and bulk. Louis has ascertained that it is more common in young than in old persons, and in females than in men, in the ratio nearly of four to one.

The bile seems to be considerably altered in this affection, both in its chemical and physical properties. Dr. Addison, of London, who has published an able essay upon the subject in a late number of Guy's Hospital Reports, states that this fluid is frequently of a dirty-brown color, and contains an infinite number of carbonaceous granules. After the addition of almost any of the acids, a most intolerable odor is evolved. The urine, too, is usually a good deal altered, being of very low specific gravity, quite neutral, and holding in suspension numerous flakes of mucus.

There are no signs, either general or local, which characterize this singular state of the liver. How far the symptom, recently pointed out by Dr. Addison, forms an exception to this remark, is a question, which, for the present, must remain undecided. The symptom to which I allude consists in a peculiar alteration of the color and texture of the integuments, most conspicuous on the face and back of the hands. These parts exhibit a singularly bloodless, almost semi-transparent and waxy appearance, which by degrees becomes observable over the whole body. Sometimes the skin has a fine, polished, ivory look. To the touch, it is remarkably smooth, loose, flabby, and almost as soft as satin, apparently from the natural asperities being obliterated. In several instances, in which this peculiar condition of the integuments was present, Dr. Addison confidently and correctly predicted the existence of the fatty degeneration of the liver.

The liver is sometimes remarkably changed in its color. Thus, it may be of a light drab, milky-white, dusky-brown, nutmeg, yellowish-grey, amber-yellow, bronze, olive, slate, jet-black, or purple. The alteration may be general or partial, superficial or deep-seated, continuous or maculiform. A bluish, slate, or grey color is often present when the organ is apparently perfectly healthy. The livid or purple hue is most common in congestion of the portal circle; the different shades of drab and yellow, in the fatty degeneration; the black, in acute hepatitis of tropical climates; and the bronze, grey, and olive, in the remittent fever of the United States. Dr. Stewardson, of Philadelphia, found this alteration so constantly in those who died of this disease under his care, that he is disposed to regard it as its essential anatomical characteristic. The color consisted of a mixture of grey and olive, bronze, or some shade of lead, which had entirely supplanted the reddish-brown, or left only faint traces of it. This alteration existed uniformly or nearly so throughout the whole extent of the organ, except in a single instance, in which a part of the left lobe retained its natural complexion. The liver was frequently enlarged, and its consistence generally diminished: the bile in the gall-bladder was abundant and perfectly fluid: the spleen was softened and enlarged in every instance. The discoloration described by Dr. Stewardson has been noticed several times by other observers; but the number of cases is altogether insufficient to settle the question, whether it constitutes the distinctive anatomical feature of remittent fever.



The color of the liver is very much altered in yellow fever. Dr. Chisholm, in his dissections in the West Indies, in 1793, found the organ of a color nearly approaching to buff, or a mixture of yellow and cineritious. The same appearance has since been noticed by Dr. Ruffz at Martinique. In the examinations of Louis at Gibraltar, the liver was invariably changed in its complexion. The most striking tints were those of fresh butter, straw, coffee and milk, mustard, orange, and buff. This alteration of color extended, in most cases, through the whole substance of the organ, although it was more prominent in the left than in the right lobe; and was associated with more or less anæmia and dryness of the hepatic tissue. Dr. Ashbel Smith, of Galveston, Texas, found the liver of a light drab color, both externally and internally, in three cases out of seven. In one hundred and fourteen examinations by Dr. Dowler, of New Orleans, the organ was of a yellow, orange, lemon, straw, brass, gingerbread, or cork color in fifty-four; and in the remainder of the cases it presented various shades of yellow and milky, nutmeg and straw, brown and yellow, bronze and reddish, pale brown and mahogany, chocolate, mahogany and white, flaxseed, dark and greenish. It is to be regretted that this observer has not stated whether the discoloration noticed by him pervaded the entire organ, or was limited to particular parts of it.

*Tubercles* of the liver may be seated either in the substance of the organ, or scattered over its surface, giving it, in the latter case, a rough mammillated appearance. Lying in close contact with each other, or separated, as the case may be, by large intervals, these bodies are generally of a rounded shape, and consist of an opaque yellowish substance, in various degrees of maturation. Their size, although sometimes not exceeding that of a mustard-seed, is usually considerable, many of them being as big as a cherry or even a hazelnut. When the liver is thus tuberculated, it feels much harder than natural, and its vessels are compressed and sometimes greatly reduced in volume, though the organ itself rarely deviates much from the ordinary standard. In some cases, the tubercles bear a strong resemblance to those of the lungs: they have the same size, the same form, the same consistence, and, in all probability, the same origin, but are a little browner in their color. They are obviously connected, in most instances, with a scrofulous diathesis, as is manifested by their frequent coexistence with pulmonary phthisis, and by their contents being usually of a curdy nature.

Tubercles of the liver produce marked symptoms only when they are numerous, or when they are associated with hypertrophy or structural lesion. Under opposite circumstances they seldom cause much local inconvenience, or impairment of the general health. They are seen occasionally in old subjects, but are most frequent by far in children. Cruveilhier asserts that he has never seen them in adults who died of pulmonary phthisis, although he has made numerous examinations.\* Louis,† however, has been more successful; for, in one hundred and twenty-three cases of consumption, he met twice with tubercles of the liver.

I have also, in a few cases, found them in association with tubercular phthisis, though more commonly without it. On the whole, I am induced to believe that this lesion of the liver is of rare occurrence in this country. In some of the inferior animals they are sufficiently common, and in none more so than in the sheep, in which they are observable at a very early age.

*Scirrhus* always occurs in distinct masses, the size, form, and consistence of

\* Dict. de Méd. et de Chir., t. viii., p. 329.

† Pathological Researches on Phthisis.

which exhibit numerous diversities. The smallest are frequently not larger than a mustard-seed, but their volume may equal that of a chestnut, a walnut, or an orange. In a specimen in my private collection, the tumors, two in number, are about the size of a common apple: they are of a spherical form, hard, dense, gristly, and situated in the very centre of the organ. The masses sometimes lie close together, and, by their agglomeration, form a tumor equal in size to a fetal head. These heterologous structures seldom occur singly. In the majority of cases, there are not less than six or eight; and instances have been known where there were as many as two or three hundred.

In their form, these tumors are generally spherical; and those which project beyond the surface of the liver, for which they have a great predilection, have often a white-greyish dimple in their centre, produced probably by a condensation of the subserous cellular substance. The smallest, and those of recent formation, are of an opaque white appearance, and intimately connected with the surrounding tissues; such, on the contrary, as are old, and of great magnitude, are often of a brownish color, with various shades of grey and black, and can be easily lifted from their situation. Vessels frequently shoot into them, sometimes so large that they can be filled with injecting matter: nerves and absorbents they also no doubt receive, but their existence has not been demonstrated by actual observation. To the touch they are hard and firm; like fibro-cartilage, the largest and densest yielding a slight creaking sound under the knife. The section generally displays a fibrous structure, the fibres radiating irregularly from the centre towards the circumference, like those of a turnip. In other cases, the tumor is lobulated and internally areolar, filaments of a greyish, brownish, or yellowish hue intersecting it in every possible direction. A juice may be obtained from them by pressure, and, in the cellular variety, a substance of the consistence and color of thin putty, paste, or concrete lard. Small masses of blood are sometimes diffused through them; but this occurrence is seldom witnessed, except in such as are old, or in a declining state.

The hepatic substance in the immediate neighborhood of these bodies is in most cases perfectly sound. In others it is indurated, softened, infiltrated with different kinds of matter, or partially absorbed. Hypertrophy of the liver is sometimes observed; but a much more common occurrence is an extreme reduction of its weight and bulk. When the tumors are numerous, the larger vessels are apt to be compressed; and, as a consequence, the organ is often exsanguine. From the same cause may result obstruction in the hepatic duct, with retention of the bile, and yellowish discoloration of the parenchymatous texture.

*Encephaloid* disease of the liver is occasionally observed, though not so often as scirrhus, with which it probably has a similar origin. Like the preceding variety, this species of cancer occurs in various sized masses, of a greyish white color, soft, compressible, and elastic, with trifling vascularity. They offer very little resistance to the knife, and are composed of an areolar mesh-work, occupied by a soft, pulpy, brain-like substance, intermixed with fibrinous concretions, and dark-colored clots. The intersections are commonly of a lighter tissue, and, instead of being dense and thick, are eminently lax and delicate. Occasionally, though very rarely, the contents of these tumors are of the nature of hard jelly, constituting the *gelatiniform sarcoma* of Portal, Cruveilhier, and other pathological anatomists. The liver is sometimes much enlarged, and presents a mixed mass of disease, carcinomatous, encephaloid, melanotic, and tubercular, in various stages of maturation. The encephaloid matter is sometimes deposited in the portal and hepatic veins, so as to exhibit a ramiform arrangement.

The symptoms of cancer of the liver are often exceedingly obscure, and frequently a long time elapses before the patient experiences much constitutional disturbance or local suffering. The disease in some instances appears to be latent, or manifests itself only a short time before death. The appetite is generally more or less impaired, the skin is sallow, the strength gradually declines, the body becomes emaciated, and there are frequent attacks of pain in the right hypochondriac region, with occasional nausea and vomiting. When the liver is much enlarged, and the cancerous tumors have attained considerable magnitude, the surface of the organ may impart a hard, nodulated, or lumpy feel to the hand applied over the abdomen, and this constitutes the only pathognomonic sign of which we have any knowledge.

It is seldom that the liver is affected with *melanosis*. When it occurs here, it exhibits the same characters as in the other organs, and need not therefore be particularly described. I have rarely seen this disease in the human liver, but repeatedly in that of the ox, in which it is by no means uncommon, especially in such as are raised in Ohio. In one specimen, the organ contained a great number of melanotic masses, arranged in the form of encysted tumors, varying in size from a small pea to a walnut. In man, the matter either assumes the tuberiform arrangement, or is diffused throughout the parenchymatous structure as an infiltration.

*Hydatids* of the liver may occupy the interior of the organ, or stud its surfaces. (Fig. 172.) Like tubercles, they may occur at any period of life, although they are most usually witnessed in adults, and in persons who have been addicted to intemperate eating and drinking. Commonly of a globular shape, they are

Fig. 172.



often closely clustered together, and are almost always contained in a cyst, formed of a dense, fibrous texture, of a white, opaque appearance. In an examination which I made about eighteen months ago, the hydatids looked like spherical bags, the largest of which was about the size of an onion, whilst the smallest was scarcely as large as a rifle-ball: their external tunic was dense, opaque, marked with numerous yellowish dots, and liberally supplied with vessels: their number did not exceed fifteen. The liver was much reduced in size, pale in color, and in many places so soft as to be unable to withstand the slightest pressure of the finger.

When these bodies are large or numerous, they may perforate the liver, and escape into the peritoneal cavity, as I witnessed in a man, thirty-five years of age, whom I attended along with Dr. Richards, of Cincinnati. The hydatids were of a dirty yellowish color, opaque,

and from the size of a marble to that of a pullet's egg. They had been contained in a large sac in the right lobe of the liver, the anterior surface of which had



given way, and thus permitted them to pass into the abdominal canal, where they speedily excited fatal inflammation. In some instances they may escape into the alimentary canal, and be discharged with the fæces.

These parasites are not peculiar to the human subject; they occur also in animals, especially in the ox, hog, and sheep. In these quadrupeds, the organ is sometimes completely crowded with them, immense numbers being every where scattered through its substance. In the liver of a cow, Mr. Youatt found nearly three hundred of these singular animals, from the size of a sparrow's egg to that of a swan. Some of the cysts were filled with blood, or lymph, and many were intersected by fibrous bands. The liver weighed one hundred and thirty-seven pounds, and measured, from one lobe to the other, more than a yard and a quarter: its centre was perfectly fibro-cartilaginous, without any trace of its original structure.\* This case is an exceedingly interesting one, and I mention it here not only with a view of showing the great number of hydatids that are sometimes congregated together, but also for the purpose of pointing out the fact, that the liver may be sometimes almost totally disorganized, and still the animal not evince any serious indisposition. The disease in this instance had no doubt existed for a long period, yet the cow's health was but little impaired; enlargement of the belly, yellowness of the skin, and slight emaciation, being the only symptoms which she exhibited previously to being killed by the butcher. In the human subject, there are no manifestations of the presence of these bodies, apart from those of chronic hepatitis. The disease may simulate ascites; and not a few cases are recorded in which the patient was actually tapped for this complaint.

Less complicated in their structure than hydatids are those *serous cysts* which are sometimes observed on the surface of the liver, and which constitute what writers have described under the name of encysted dropsy. The walls of these vesicles are generally transparent, smooth, polished, and supplied with numerous vessels, of the finest texture and most beautiful arrangement. Their contents, which are thin and limpid, like the water of ascites, are coagulable by heat, alcohol and acids. In the only case in which I have observed these tumors, they hung pendulous from the convex surface of the liver, in the form of globular bodies, about the size of a walnut. Their most common size is that of a grape; but they may increase to a magnitude capable of holding many pints. Thus, in a man aged thirty-two, Dr. Abercrombie found a cyst which contained eighteen pounds of fluid, and the walls of which were firm and dense, like thickened peritonæum. At the bottom of the sac were two coiled up cylindrical bodies, of a soft gelatinous consistence, which, when unrolled, had the appearance of false membranes, being about ten inches in diameter, and the eighth of an inch in thickness. The liver was not altered in structure, and all the other abdominal viscera were in a normal state. The patient had experienced much suffering, caused mainly, perhaps, by the encroachment of the immense tumor upon the diaphragm and surrounding organs.

The *liver-fluke*, the *distoma hepaticum* (Fig. 173), of helminthologists, although it has been several times seen in the human subject, is much more common in the inferior animals, as the sheep, horse, stag, and ox. It is also found in the gall-bladder; and Pallas mentions that he once detected it in the hepatic duct of

Fig. 173.



a, the mouth;  
b, suctorial  
disc; c, gene-  
rative orifice.

\* The Management and Diseases of British Cattle, p. 460. Phila. 1836.

a young female. Somewhat lanceolated in shape, it is of a yellowish color, obtuse at each extremity, and scarcely a fourth of an inch long by one line in breadth. It has two openings, one in front, which is directed obliquely inwards, and another behind and inferiorly, which is slightly prominent, and answers to the anus; the neck is rounded, and of a light brownish hue: the belly is marked by spots of an opaque dingy white. The insect is thought to have a distinct genital apparatus, with a vascular, and probably also a nervous system. In animals, it is often an inch long, by nearly half an inch in breadth.

Worms sometimes crawl from the duodenum into the liver, where they have been known to create profuse suppuration, followed by fatal irritation. Of this I have never seen an example in the human subject, but several highly interesting cases of it are recorded by writers.

The late Dr. Bond,\* of Philadelphia, has detailed the particulars of an extraordinary instance of hepatic disease occasioned by a worm twenty inches long by twelve lines in diameter. It was of a rounded form, annular, red in its color, and filled with blood in the manner of a leech. The liver was uncommonly hard, as well as considerably enlarged, and presented a large cavity containing nearly two quarts of sanguinolent fluid, with a small quantity of coagulated blood. On the side of this cavity was a receptacle two inches in diameter, and in the bottom of it a passage leading into the hepatic duct, the mouth of which was pursed up, and appeared to have been a good deal expanded. The outlet of the choledoch canal in the duodenum was so much dilated as readily to admit the end of a common tallow candle. The liver adhered to the peritonæum, the gall-bladder was distended with black bile, and the alimentary tube was in a natural state. The patient, a female, whose age is not stated, was affected for eighteen months before her death with pricking pain in the right side, which gradually increased in violence, with occasional intervals of ease, and ultimately extended over the greater part of the right hypochondriac region.

An instance similar to the preceding is recorded by Mr. Paisley, in the second volume of the *Edinburgh Medical Essays*. Fontanelles,† a French writer, has described the case of a boy, thirteen years of age, who died in less than a fortnight from the lodgement of a lumbricoid worm, six inches long, in the hepatic and choledoch ducts, the parietes of which it had perforated. Professor Gibson,‡ of Philadelphia, states that he has in his cabinet a diseased liver, the substance and ducts of which are filled and perforated in every direction, by numerous and very large animals of this kind, which destroyed the child by irritation and suppuration. Many other examples of a similar description are related by authors; and it is worthy of remark that in nearly all of which we have any account, the parasites belonged to the lumbricoid species. In the liver of the hog I have frequently seen the vessels and excretory ducts of the liver filled with small worms of this kind. In this animal they generally coexist with hydatids. In old dogs, Dr. Bond states, in the work previously referred to, that he has seen lumbrici upwards of three feet long, and nearly two inches in circumference.

In examining, not long ago, the liver of a rat, I discovered a serous cyst about the size of a small marble, on the under surface of the organ, which contained a tania one foot in length by two lines in breadth. (Fig. 174.) The parasite

\* *London Medical Observations and Inquiries*, vol. i., p. 68.

† *Johnson's Medico-Chirurgical Review*, vol. viii., p. 287.

‡ *Institutes of Surgery*, vol. i., p. 134. Fifth edit.

was completely coiled up, and lived for upwards of an hour after its removal. The liver itself was perfectly sound. The specimen is preserved in my museum of pathological anatomy. Professor Cobb possesses a similar preparation, and I find that another has been described by Dr. Capelle, in the first volume of the Transactions of the College of Physicians of Philadelphia.

*Cartilaginous* deposits are sufficiently rare in this organ; most frequently they are confined to the investing membranes, occurring in small patches, of a soft texture and greyish color. Dr. Roberts, of Paris, relates a case in which the whole of both tunics was converted into one mass of cartilage, in some places half an inch thick. In the midst of this substance were several scales of bone, one of them of the size of a half-crown piece.

The deposits are sometimes entirely *osseous*. Dr. Venables\* met with a case in which the concretion, consisting almost entirely of phosphoric acid and lime, was about the size of the patella, with very much the same shape. It was embedded in the parenchymatous structure, and resembled common bone. In other cases the earthy matter is soft, gristly, of a brownish white color, and enclosed in a dense, firm, fibro-cartilaginous cyst.

I have repeatedly met with very small osseous concretions in livers otherwise perfectly healthy. (Fig. 175.) In one case there were altogether about fifteen, varying in volume from a mustard seed to a currant. They were hard, somewhat gritty, of a yellowish hue, and most of them were distinctly encysted, the capsule, which was of a greyish color, and fibro-cartilaginous firmness, being from the sixth to the fourth of a line in thickness, and closely adherent to the surrounding tissues. In another case, the concretions were only five or six in number, the largest of which was about the size of a common pea. They were also encysted, but of a light brownish color, and of great hardness. How these little bodies originate, cannot be very easily determined. In one of the cases referred to, it seemed to me that they were nothing but tubercles in a state of osseous degeneration; a supposition which is favoured by the fact that several of them, evidently less advanced than the rest, contained a minute quantity of curdy, friable matter. The individual, moreover, was of a decidedly scrofulous habit, and numerous tubercles existed in different organs.

Blood sometimes escapes into the substance of the

Fig. 174.

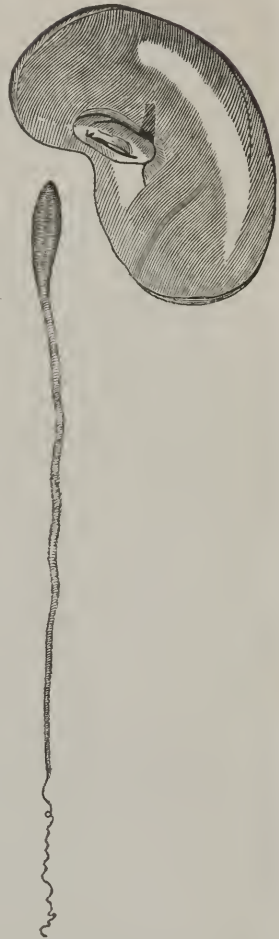
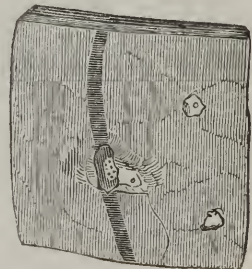


Fig. 175.



\* London Cyclopaedia of Practical Medicine, vol. iv., p. 611.



liver, constituting the disease to which some of the French writers have applied the name of *hepatic apoplexy*. It generally proceeds from one or more ruptured vessels distributed through the parenchymatous texture, and occurs in small spots, varying in density and color according to the length of time they have existed, being always softer and darker the more recent they are. The disease, I presume, is extremely rare, as very few pathologists make mention of it. In my own dissections I have never met with an instance of it; nor am I aware that any of my friends have been more successful. No symptoms have yet been pointed out as indicative of hepatic apoplexy; nor is it reasonable to suppose that the organ would suffer much inconvenience, unless the effusion should be copious.

*Erectile tumors* of the liver are of very rare occurrence, and have seldom been observed independently of the existence of other disease. Embedded in the substance of the organ, from which, however, they usually project upon its surface, they are of an irregularly rounded shape, and vary in size from that of a small marble to a walnut. They are composed of an areolar, spongy structure, the meshes of which are remarkably numerous, irregular in their form, and occupied by dark grumous blood. Some being surrounded by a distinct fibrous envelope, a section of a mass of this kind bears the greatest possible resemblance to the cavernous body of the penis; whence the name of the disease. It is seldom we meet with more than one erectile tumor in the liver; in a case, however, described by Berard, there were as many as three, the largest being about the volume of a walnut.

*Laceration* of the liver is probably a much more frequent occurrence than is generally imagined. Only a few examples of it are, it is true, on record, but it is not unlikely that many happen which are never reported. The accident is always produced by external violence, as by a fall from a considerable height, or by the passage of the wheel of a carriage. A case of extensive laceration of this organ, from a very slight cause, is related by Dr. Pearson, in the third volume of the Transactions of the College of Physicians of London. A young man, in ascending a ladder, fell from the sixth step, and struck his right side against the edge of a pail which he had in his hand. Death happened in ten hours after the accident. The right lobe of the liver was divided, in an oblique direction, through its entire thickness, from its extremity on the right side to the border of the left lobe; the two portions being connected only by the hepatic and great hollow veins. In the full grown fœtus, Cruveilhier\* thinks that when the liver extends considerably below the ribs the slightest pressure on the right hypochondriac region might be sufficient to lacerate the organ. He refers to a case which fell under his own observation, where the appearances were such as to induce him to believe that the mere pressure of the genital organs of the mother might in some instances produce considerable contusion of this viscus.

Rupture of the liver may take place without any mark of violence externally. In a great majority of cases, however, there is more or less contusion with ecchymosis of the skin, cellular tissue, and muscles, immediately over the affected organ. Along with this lesion there may be laceration of the spleen, intestines, kidney, or even of the pancreas, with fracture of the ribs, sternum, spine, or pelvic bones. "In other cases the cranium and brain are the parts which suffer most in injuries producing rupture of the liver. M. Richerand,† in support of the particular views which he entertained respect-

\* Dict. de Méd. et de Chir. Pratiqu., t. viii., p. 318.

† Nosographie Chirurgicale, t. ii., p. 227. Edit. 1808.

ing the formation of abscesses of the liver after injuries of the head, has mentioned some cases in which individuals whose skull had been fractured in consequence of their falling from a height, and who died within twenty-four hours after the accident, were found to have their livers also lacerated. He caused about forty dead bodies to be precipitated from a height of about eighteen feet, and found that in these bodies the brain and the liver were always more or less injured, the latter presenting, in some instances, lacerations of considerable depth. No viscus, he says, without excepting even the brain, suffered more than the liver from the violent commotions produced by the fall."\*

The number, extent, situation, and direction of the lacerations vary in different instances, and do not admit of any definite statement. I give the following case in illustration of the subject. John Shidaker, a stout athletic German boatman, twenty-three years of age, was admitted into the Louisville Marine Hospital, June 29th, 1844, for an attack of bilious remittent fever, under which he had labored for the last three days. On the 2d of July, in a paroxysm of delirium, he jumped over the portico upon the pavement below, a distance of fifteen feet, bruising the right hip, and wounding the forehead and right forearm. Death took place in about one hour after the injury. On examination, Mr. Pyles, the resident physician, who has kindly furnished me with the particulars of the case, found the liver lacerated in not less than thirteen places. The largest rent, situated on the right lobe, towards its inferior margin, was rather more than six lines in depth, and ran in a crescentic direction for four inches from near the right border of the organ towards the left side. Two other fissures, both transverse, the one three, and the other two inches in length by eight lines in depth, existed above the preceding, together with two smaller, one of which looked more like a puncture than a laceration. The posterior surface presented eight rents, the largest of which, nearly three inches long, extended transversely across the organ, a little below its middle. The others ran in different directions, and, with the exception of two, were perfectly distinct from each other. None of these rents, either on the anterior or posterior surface, extended through the whole substance of the liver; which was somewhat enlarged, softened, and of a dark bluish color. The gall-bladder was distended with a thick, dark, grumous, tar-like substance. The spleen, which was very much enlarged and extremely soft, was ruptured on its convex surface, and a part of its contents had escaped into the peritonæal sac. The right kidney was ecchymosed, and the small intestine extensively contused. The abdominal cavity contained upwards of eight pounds of fluid blood. None of the large vessels were injured. The brain and thoracic organs were healthy.

The quantity of blood poured out in laceration of the liver varies from several ounces to six or eight pounds. The accident is always fatal, the patient, if he do not die immediately, seldom surviving more than a few hours. To this statement, however, a remarkable exception is to be found in a case, by Dr. Fazely, of the island of Trinidad. The individual, a man fifty years of age, survived the effects of the injury eight years, and finally died from a complication of disease. On examination, it was found that the right lobe of the liver had been ruptured throughout its whole length and substance, from the anterior to the posterior part, and that the lacerated edges had perfectly reunited through the medium of a broad, thick cicatrice, of a hard cartilaginous texture. In the interior of this cicatrice, at the depth of half an inch, a

\* Thomson, Practical Treatise on the Diseases of the Liver, p. 71. Philad. 1842.

considerable cavity was seen, which communicated with the hepatic tissue, and contained about fifty biliary concretions. The surface of the liver adhered extensively to the walls of the abdomen. The gall-bladder was empty and flaccid, and the alimentary tube perfectly sound.

That such accidents are not so fatal as has been generally imagined, may be inferred from some experiments performed by Monro, of Edinburgh. He opened the abdomen of a living rabbit, and cut off one of the lobes of the liver. The divided vessels bled very profusely; but, by pressure, the hemorrhage entirely ceased in the course of three or four minutes. After the wound was sewed up, the animal appeared uneasy, but only for a short time, when it gradually recovered its spirits, and took food as before. During the five weeks that it was kept and closely watched by the experimenter, it was in perfect health, the digestion going on well, and the alvine evacuations being of the usual color, quantity, and consistence.

In another experiment, also performed upon a rabbit, the results were precisely similar. The animal lived upwards of twelve weeks, when it was killed. On examination, the cut surface of the liver was found firmly glued to the walls of the abdomen, by means of lymph.\* The results of these experiments are extremely interesting, as showing how large a portion of an organ, so important to life, may be ablated or destroyed, and yet the animal perfectly recover.

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## SECTION II.

### OF THE GALL-BLADDER.

I. Inflammation of the gall-bladder, characterized by the usual anatomical appearances, may be caused by irritating bile, by the presence of biliary concretions, or by external violence. Very frequently it coexists with duodenitis, or with inflammation of the substance of the liver, or of one or other of its envelopes. The disease commonly assumes the chronic type, though occasionally it enters into suppuration, the quantity of matter being sometimes very considerable. In a case recently reported by Dr. James Johnson,† of London, the gall-bladder, dilated into an enormous sac, contained a pint of thick purulent fluid, mixed with a large number of calculi. The cystic duct was entirely obliterated, and the walls of the tumor, which had contracted extensive adhesions to the adjacent organs, were much thickened, and in some places ulcerated. In many instances, the pus is of a peculiar greenish aspect, owing to the admixture of bile; more rarely it is thin, sanious, and extremely offensive.

Ulceration of the gall-bladder generally begins in the internal coat, being usually caused by the irritation of biliary calculi. In this manner extensive abrasions are sometimes produced, with hard, elevated edges; when there is obstruction of the cystic duct the disorganizing process may implicate the other tunics, and finally lead to perforation and escape of the bile. The immediate effect of this accident is violent peritonitis, rapidly terminating in death. In a case of rupture of the gall-bladder, reported in the *Western Journal of the Medical and Physical Sciences*, by Dr. Rogers, the patient survived the escape

\* *Elements of Anatomy*, vol. i., p. 567. Edinburgh, 1831.

† *Medico-Chirurgical Review*, July, 1836.



of the fluid sixty hours ; and in another, the particulars of which are given by Professor Drake, death took place at the end of the third day. In the former case, the gall-bladder contained a large, rough calculus, and the rent, which was about half an inch in diameter, occupied the side of the organ ; in the latter, the viscus was contracted, and the opening, which was very small and evidently caused by ulceration, was situated near the cystic duct. Professor Drake's patient was thirty-four years of age, and the rupture which occurred soon after eating an ordinary supper, was announced by violent pain in the region of the liver, which continued, with slight intermission, until a short time before he expired. The abdomen was swollen, tense, and painful on pressure ; countenance pale and haggard ; stomach exceedingly irritable ; bowels constipated ; secretion of urine suspended ; pulse weak, small, and one hundred and twenty-four in the minute ; drowsiness ; dyspnœa ; and inability to lie on either side.\*

*Rupture* of the gall-bladder may occur as a consequence of external violence. The accident, however, is exceedingly rare, and is usually accompanied by extensive mischief in other parts of the body. Falls from a height, the passage of a carriage-wheel, and severe blows upon the right hypogastric region, are the most common causes of it. In a case mentioned by Alberti† it was produced by a kick in a scuffle. Death may succeed immediately to the injury that occasions the laceration, or it may be postponed for a number of days or even several weeks. Lesseure, in his Inaugural Essay on Rupture and Perforation of the Gall-Bladder, published at Paris in 1824, has referred to five instances of this occurrence, in four of which life was destroyed within a few hours ; while in the fifth, the patient, a child of twelve years, survived the accident four days. In a boy, fourteen years old, whose case has been described by Dr. Skeete,‡ death did not take place until the end of the sixth week.

The gall-bladder may be affected with atrophy, accompanied with partial or total obliteration of its cavity. In three or four instances I have seen it reduced to a mere fibrous mass, without any trace of its normal configuration. In a specimen in the museum of the Louisville Institute, the cystic duct is annihilated, and the coats of the gall-bladder, considerably thickened, are rigidly contracted over five or six small calculi. When thus wasted, the reservoir may be easily overlooked, and induce the belief that it is entirely absent. The most common cause of atrophy of this organ is an obstacle in the cystic duct preventing the influx of bile ; but in many cases it exists without any assignable reason.

The coats of the gall-bladder are occasionally in a state of hypertrophy. Dr. Dowler,§ of New Orleans, one of the most zealous cultivators of pathological anatomy in the south, has recently described, under the name of the *oyster-like degeneration*, a very singular variety of this lesion, which is said to be of very common occurrence, especially in yellow fever. The coats of the organ, unusually white, and of moderate consistence, are from three to six lines in thickness, and composed of innumerable filaments, similar to those of raw cotton, and intersecting a semi-opaque, gelatinoid substance, almost dry, and free from vascularity. The cavity of the reservoir is often diminished in size, and usually contains more or less albuminous fluid, nearly as transparent as water, and without the slightest trace of bile.

The walls of this reservoir may also be partially transformed into cartilaginous,

\* Western Journ. of the Med and. Phy. Sciences for 1834, p. 521.

† Systema Jurisprud. Medicæ, t. vi., ob. 19.

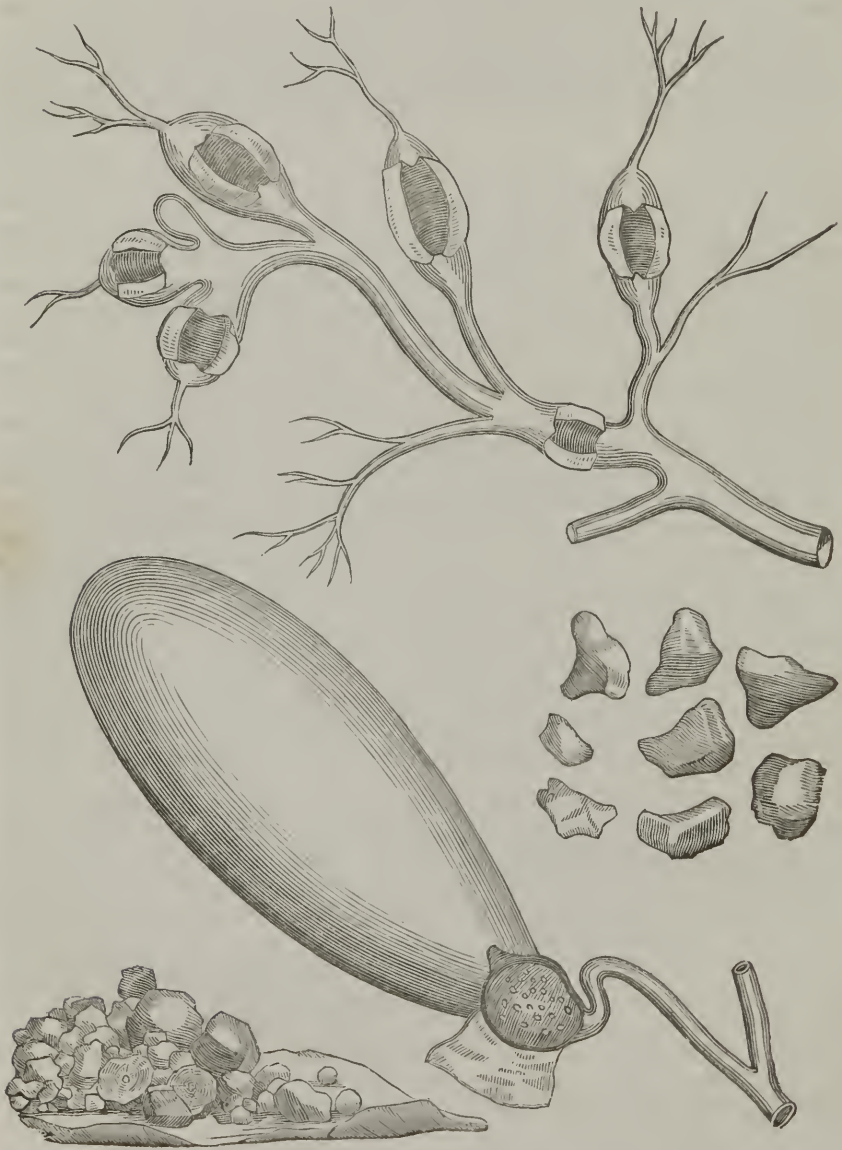
‡ London Medical Journal, 1785, vol. vi., p. 274.

§ Western Journal Med. and Surg., vol. viii., p. 250.

calcareous, and even osseous matter. Dr. Baillie mentions an instance where they were above a quarter of an inch thick, and studded with large tubercles, of a remarkably firm texture. Hydatids and worms are also sometimes found in the gall-bladder.

Dilatation of these tubes, caused by some obstacle to the egress of the bile, is a common occurrence. (Fig. 176.) Baillie saw the hepatic and choledoch

Fig. 176.



ducts nearly an inch in diameter; and Cruveilhier details the particulars of a case where the latter of these passages was of the size of the duodenum.

“Instances of rupture of the biliary ducts are much rarer than those of rupture of the gall-bladder. M. Campaignac,\* however, has related a case in which a man, thirty-five years of age, who had received a violent blow from a carriage on the right hypochondrium, having died eighteen days after the accident, the left branch of the hepatic duct was found to exhibit, near the lobe of Spigelius, a longitudinal rupture, with unequal borders, capable of permitting the introduction of the end of the small finger. The abdomen contained about six pints of a deep green fluid. The folds of the intestines were united to one another by a half organized false membrane, which lined also the anterior parietes of the abdomen, and other marks of inflammatory action were perceptible.”†

A number of examples of considerable dilatation of this reservoir from retention of the biliary fluid are recorded. Cruveilhier met with one in which a mass of indurated absorbent glands, compressing the common duct, had caused the organ to enlarge to the size of the urinary bladder. An equally astonishing case, in which it contained eight pounds of inspissated bile, is reported by Mr. Gibson, in the Edinburgh Medical Essays. When thus enlarged, the gall-bladder forms a pear-shaped tumor, which projects beyond the ribs, and sensibly fluctuates under the finger. There is no sign by which it can be discriminated from other lesions. Indeed, the diagnosis is not only obscure, but sometimes very deceptive. A distended gall-bladder has been mistaken for a hepatic abscess; an opening has been made into it; bile has escaped instead of pus, and this, getting into the peritonæal sac, has speedily destroyed life. A remarkable case of this kind, which fell under the observation of the late Mr. Todd, of Ireland, is related in the Dublin Hospital Reports.

II. The *biliary ducts* are liable to the same lesions as the gall-bladder, in the structure of which they participate. Thus they may be affected with inflammation, acute or chronic, softening, induration, ulceration, and even perforation. In the latter case the bile escapes into the peritonæal sac, and induces disastrous results. In more than half a dozen instances have I found the cystic duct obliterated and transformed into a dense, fibrous cord; similar lesions have occasionally been observed in the hepatic and choledoch ducts. The affection, however, I have reason to believe, is much more common in the former than in either of the latter of these tubes. Most generally the obliteration arises from the irritation of a gall-stone, or from the pressure of some tumor, as the head of an enlarged pancreas or a scirrhous lymphatic ganglion.

III. Healthy bile is a greenish-yellow fluid, of a viscid,ropy consistence, readily miscible with water, of a peculiar sickening odor, and of a taste at first sweet and then bitter. Of the precise amount of bile secreted in the twenty-four hours, we have no means of judging, probably it does not exceed two or three ounces. From these normal states of the fluid, there may be numerous deviations, depending upon the condition of the liver, or the period of its retention in the gall-bladder. Thus it may be unnatural in its color, augmented or diminished in quantity, unusually acrid or bland, uncommonly thin or viscid. In some diseases of the liver the bile is of a deep black, and in several instances I have found it of the color and consistence of a warm solution of arrow-root. In addition to these tints, there are often numerous intermediate shades of green, reddish, brown, orange, and yellow. In warm weather, the quantity of bile is generally much greater than in cold seasons, and the fluid is also more acrid and stimulating, frequently inducing diarrhœa, cholera-morbus, and spasmodic colic. Its consistence may be as thin as water, or as thick as molasses, tar,

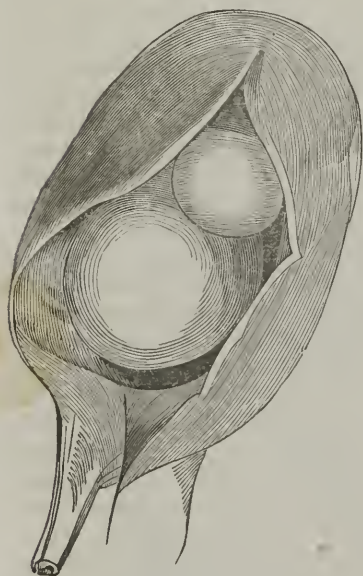
\* Jour. Hebdom. 1829, t.ii, p. 219.

† Thomson, the Diseases of the Biliary Organs, p. 76. Phila. 1842.



mucilage, or half-dissolved glue. In the diseases of tropical climates the bile is sometimes so hard and viscid that it can scarcely be forced along the excretory ducts. In organic affections of the liver it is occasionally of the color and consistence of coffee-grounds; and in chronic hepatitis I have several times seen the gall-bladder distended with a thin reddish bile, not unlike the juice of the pokeberry. In some cases, if tasted, the fluid produces no particular inconvenience; in others, it is so poisonous in its qualities as to cause violent irritation, and even death. In most of these abnormal states of the biliary fluid, there are important alterations in its different chemical elements, consisting either in their modification, or in the abstraction of some, or the substitution of new ones. Simply changing the food, or, in other words, modifying the blood, enables us to alter at pleasure the composition of the bile.

IV. *Gall-stones* may be formed in the ducts of the liver, but most generally they originate in the gall-bladder, where they are often accumulated in great numbers (Fig. 177). John Hunter examined a case in which there were above a thousand; and Morgagni refers to one in which there were three thousand six hundred and forty-six. When thus numerous, they are commonly very small, frequently not exceeding a bird-shot; under opposite circumstances, however, they often attain a considerable magnitude. The largest I have ever seen was about the size of a walnut. Hildanus mentions one which weighed eighteen drachms; and Dr. Baillie saw another which was fully the size of a hen's egg.



Much diversity prevails in relation to the form and color of these concretions. When numerous, they are often perfectly smooth, and marked off into regular sides and angles, evidently occasioned by their mutual friction. In this manner they may assume various mathematical figures, as the tetrahedral and hexagonal. In the gall-bladder of a man of fifty, whom I examined in 1828, there were

seventy-one of these six-sided concretions, none of which exceeded the dimensions of an ordinary pea: they were of a deep brown color, and emitted on exposure to heat a peculiar fragrant odor, not unlike frankincense. When there is only one gall-stone, it is usually of an oval shape, with a rough, grooved or tuberculated surface. The principal colors of these concretions are brown, cinnamon, and black; with numerous intermediate shades, which it is difficult to indicate. Sometimes they are semi-transparent, and of a white pearly lustre: when they are formed in the substance of the liver, it is not unusual to find them of a dingy black, not unlike grumous blood.

Gall-stones often possess a considerable degree of solidity, and are commonly found to consist of a number of concentric laminæ, placed around a radiating nucleus. This central structure is frequently much softer than the exterior, and is sometimes made up entirely of inspissated bile.

The nature of these concretions has been investigated by numerous chemists; but the most satisfactory analysis is that by Chevreul. According to this, gall-stones are composed of the yellow coloring matter of the bile and cholesterine;

the latter generally predominating, and, in many instances, forming the entire concretion.

Professor Thomson,\* of the University of Glasgow, supposes that all biliary concretions may be referred to three species — the *cholesteric*, *mellitic*, and *inspissated*. The first variety, composed nearly entirely of cholesterine, is of a white pearly lustre, with a slight shade of brown, of a spherical shape, and of a crystallized, laminated structure. It is of low specific gravity, without taste or smell, without acid or alkaline properties, insoluble in water, partially soluble in boiling alcohol, and fuses at a temperature of about  $279^{\circ}$ . The mellitic concretion, by far the most common, has been thus named by Professor Thomson, from its dark, honey-like color. It is soft, smooth, and always of a polygonal shape, being generally composed of two tetrahedrons, applied base to base, with their edges and angles rounded off. Externally it consists of thin, concentric layers of cholesterine, spread over a nucleus of indurated bile strongly resembling granulated honey. The third variety, as its name indicates, is wholly composed of inspissated bile: it is of a yellowish cinnamon hue, semi-concrete in its consistence, and much more uncommon than either of the other species.

Biliary calculi induce *symptoms* only when they are in the act of passing towards the bowel. As long as they remain in the gall-bladder, they are productive of little annoyance, even though they be large and numerous. In the former case, that is, when they are about making their egress, they frequently create the most intense suffering. The pain is of a spasmodic kind, and usually comes on in sudden paroxysms, though occasionally it continues for hours together; the stomach is oppressed with nausea and vomiting; and the surface is bathed with a cold, clammy sweat, preceded and accompanied by rigor. The bowels are constipated, the *fæces* pale, the urine scanty and high-colored, the eyes sallow, the skin of a deep yellowish tint. When all or most of these phenomena are present, there can, in general, be no doubt respecting the true nature of the complaint; yet it is important to remember, as has been remarked by Dr. Marshall Hall, that precisely similar symptoms may originate from a diseased and crowded state of the colon.

Gall-stones are more common between the ages of forty and fifty than at any other period of life. They are most frequently observed in persons of sedentary habits, and hence women are more subject to them than men. It is stated that in England five-sixths of all the cases of this affection occur in the female sex. Whether the proportion is equally great in this country, I am unable to say, as the subject has not been particularly investigated.

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## CHAPTER XXIII.

### OF THE SPLEEN.

Normal characters of the Spleen. — Its Color, Weight, Dimensions, and Intimate Organization. — Acute Splenitis. — Anatomical Characters. — May pass into Suppuration or into Gangrene. — Softening. — Induration and Hepatization. — Hypertrophy and Atrophy. — Tubercles. — Calcareous Concretions. — Fibro-Cartilaginous and Osseous Matter. — Hydatids and Serous Cysts. — Sanguineous Deposits. — Laceration.

THE *spleen*, situated deeply in the left hypochondriac region, lies beneath

\* London Cyclopædia of Practical Medicine, vol. i., p. 337.

the diaphragm, behind the descending colon, and immediately over the left kidney. Externally, it is convex, and corresponds to the ninth, tenth, and eleventh ribs; internally, where it is slightly concave, it is perforated by six or eight foramina for the passage of vessels, and in contact with the stomach and pancreas. Thus the spleen is in relation with a number of highly important organs, upon all of which it must encroach, to a greater or less extent, when in a state of hypertrophy. In case of excessive enlargement, it might sensibly interfere with the motions of the diaphragm, and thus cause difficulty of respiration; with the stomach, and thus occasion indigestion; or with the colon and small bowels, producing displacement, together with difficulty of voiding the fæces. The great vessels would also be apt to be compressed, and in this manner might result an unequal distribution of the blood, some of the viscera being surcharged, others sparingly supplied with it. Moreover, by interfering with the ready return of this fluid from the abdomen and pelvis to the heart, as must necessarily happen whenever there is an obstruction in the ascending hollow vein, ascites will be induced, generally of the most intractable kind. Naturally, the spleen is attached in a loose manner by vessels and peritonæal folds; but in certain states of disease, it is more or less firmly agglutinated to the circumjacent viscera.

In shape, the spleen resembles the longitudinal section of an ellipse, being convex on one side, and nearly flat on the other. Its margins are of unequal thickness, and not unfrequently, though not always, intersected by notches. The color, varying from pale grey to dark brown, is considerably influenced by the age of the individual, the nature of the disease, and the kind of death. In the recent subject it is generally of a light bluish cast, which, in a few hours, changes to a deep purple, so as to resemble a mass of clotted blood. This alteration always takes place very rapidly when the spleen is exposed to the atmosphere. With respect to its texture, it is soft, somewhat spongy, friable, and easily torn.

The size of this organ is subject to so much variety, even within the limits of health, as to render it impossible to lay down any definite rule concerning it. In the generality of cases, it is about five inches in length by three in width, and one and a half in thickness; but from these dimensions, there are frequent deviations. Thus I have often seen perfectly healthy spleens that were not more than three inches in length by two in breadth; and, on the other hand, some that were from seven to nine inches long, and from four to five inches wide. Not less variable is its weight. In the average number of cases, it does not exceed eight ounces; but in one instance, that of an adult male subject, I found it range as high as fourteen ounces; and in another, that of a full-grown female, as low as three and a half. The mean specific gravity of the organ, according to Krause, is 1060; according to Cloquet and Cruveilhier, 1160.

An additional spleen is occasionally found. This is more commonly the case, I believe, when the main organ is rather small. The greatest number of supernumerary spleens that I have ever seen was seven. Other writers have observed as many as ten, twelve, or even twenty. Of a rounded shape, they are about the volume of a nutmeg, and are usually situated in the gastro-splenic omentum, along the principal vascular trunks.

The spleen, like the liver, has two distinct tunics, which are so closely connected, as to render it extremely difficult, nay almost impossible, to separate them. The external one is derived from the peritonæum, and consequently of a serous character, being thin, transparent, smooth and polished. The other is of a fibrous nature, greyish in its color, compact, extensible and elastic.



Like the corresponding covering of the liver, it detaches an immense number of processes, which extend into the interior of the organ, so as to convert it into a spongy structure, not unlike the cavernous body of the penis. These processes support the ramifications of the splenic vessels and nerves, and the cavities which they form communicate freely with each other; such at least is the conclusion I have arrived at from my own examinations. In the spleen of the horse and ox, the cells are remarkably large, and, by macerating the organ for a few days in water, their pulpy contents may be easily washed out, leaving nothing but the fibrous framework, together with the vascular and nervous ramifications.

The precise nature of the pulpy substance of the spleen is not well understood. It bears a very close resemblance to the blood, whence some have supposed that it is merely that fluid in a modified condition. In all probability, however, it is a peculiar structure upon which are spent the ultimate ramifications of the splenic vessels, nerves, and absorbents, though the manner in which these terminate remains to be settled. It is of a dark brownish color, similar to that of wine-lees, extremely soft, and so strongly impregnated with albumen as to form a dense coagulum on being steeped in alcohol. Interspersed through this pulpy substance are a great number of rounded corpuscles, varying in size from that of the smallest pin-head to that of a millet-seed. Occurring either separately, or in groups, they are of a greyish color, semi-transparent, and of a soft gelatinous consistence. Their nature is quite unknown. Ruysch considers them as being composed of convoluted vessels, whilst Malpighi regards them as small glands.

The spleen, in proportion to its size, receives a larger amount of blood than almost any other organ in the body. Its principal artery is derived from the cœliac axis, and is the most capacious branch of the three which are detached from that vessel: it courses along the superior margin of the pancreas; and, as it approaches the fissure of the spleen, it divides into several trunks, which enter the parenchymatous substance at different points, having previously sent off five or six branches to the great tuberosity of the stomach. The accompanying vein is still more capacious: it is destitute of valves, and is one of the principal trunks which form the portal vein. The precise mode of termination of these vessels is unknown. It would appear, however, from the dissections of Assolant and others, that the communications between them are not so free, by any means, as in other parts of the body. It may be observed here, that the volume of the spleen varies much in proportion to the amount of blood it contains. If a ligature be thrown around the principal vein, the organ augments considerably in size, whilst the pressure exerted upon it by a distended stomach diminishes it. Lieutaud asserts that the spleen always enlarges during chymification; but this has been denied by others. The absorbent vessels of this viscus are extremely numerous. Its nerves are small, and are derived from the solar plexus: as they proceed towards their destination, they creep along the coats of the splenic artery, upon the surface of which they form a beautiful and inextricable plexus.

Until recently, the diseases of the spleen seem to have received little attention from the pathologist; and hence, as might be expected, our information concerning them is still, in many respects, vague and unsatisfactory. Independently of the imperfect manner in which morbid anatomy was cultivated in former times, various other circumstances have concurred to retard our knowledge of the different lesions of this singular organ. Amongst these not the least important are, the obscurity which still envelopes the functions of the spleen; the depth of its situation in the left hypochondriac region; the mode

of its connection with other viscera ; and, finally, the tardy and insidious way in which it becomes deranged, years sometimes elapsing before the organ suffers much inconvenience or before the rest of the body takes cognizance of the particular disorder with which it is affected. Another source of deception has arisen from a supposition, at one time very prevalent amongst physicians, that the lesions of the spleen are rare ; but that this is not the case must be familiar to every one at all extensively engaged in the practice of medicine. In fact, there are few examples of abdominal or thoracic malady, in which this organ is not more or less involved. In some countries, as Holland, South America, and certain districts of India, the diseases of the spleen are occasionally endemic ; and they are very common, wherever marsh miasm has an opportunity of exerting its malign influence. Hence intermittent fevers are rarely present without them, especially when violent or of long standing.

The lesions of the spleen may be comprised under the following heads : 1, inflammation ; 2, suppuration ; 3, gangrene ; 4, softening ; 5, induration ; 6, hypertrophy ; 7, atrophy ; 8, tubercles ; 9, melanosis ; 10, calcareous deposits ; 11, hydatids ; 12, apoplexy.

Inflammation of the spleen may be seated in its parenchymatous structure, or it may be limited to its envelopes. In many cases the serous coat remains perfectly sound, but there are probably few in which the fibrous is not more or less implicated, either primarily or consecutively. Acute splenitis seems to be a very rare disease, both in this country and in Europe : but it is very common in the East Indies, and often runs its course in a very short time. In the milder grades of the disease, or in the early stages of its attack, the substance of the organ is of a red brownish color, verging upon livid, gorged with grumous blood, and somewhat indurated : it tears with more facility than in the healthy state, is considerably swelled, and the congestion frequently extends to the great omentum, stomach, and liver, the latter of which, according to Gendrin, is ordinarily augmented in volume. At a more advanced period the spleen is reduced to a soft blackish mass, not unlike half-dissolved blood : it exhibits a homogeneous aspect, and readily breaks under the pressure of the finger. In very violent cases, lasting several days, globules of pus are not unfrequently disseminated through the disorganized structure, or collected into one or more depôts, which are either enclosed by a distinct sac, or surrounded by softened splenic substance. The peritonæal and fibrous coats, also, are more or less inflamed ; and in many instances the organ is glued to the adjacent viscera, such as the stomach, colon, or diaphragm, by masses of lymph. The splenic artery no longer admits injecting matter, and the splenic vein usually contains black grumous blood, mixed with pus. This phenomenon, however, is far from being constant.

In acute splenitis, the patient commonly complains of a peculiar fulness and sense of pain in the left hypochondriac region, increased by coughing and external pressure. Oftentimes the pain extends to the left shoulder, and is of a sharp lancinating nature, like that of pleurisy ; at other times, it is perceived over different parts of the abdomen, and leads to the inference that the individual is laboring under peritonitis or gastro-enteritis. Much difficulty is experienced in lying on the affected side ; there is a burning and oppressive sensation in the epigastric region ; and, in violent cases of the disorder, those which rapidly terminate in a general dissolution of the structure of the spleen, incessant vomiting is a frequent and distressing symptom, which is often attended by a discharge of grumous blood, both from the stomach and the bowels. The same phenomena are present, only in a more aggravated degree, when the inflammation attacks the coats of the organ. Of chronic splenitis, we shall speak when we come to consider the subject of hypertrophy.

*Suppuration* of the spleen is a very rare occurrence, though perhaps not so much so as the few cases of it on record would lead us to suppose. The pus, although frequently of the creamy kind, is sometimes hard and flaky, or thin and dark-colored, like coffee-grounds. In most cases, it is collected in a distinct sac, round which the parenchymatous structure is more or less softened, broken down, or even altogether destroyed. Occasionally the pus is infiltrated into the substance of the organ, or it occurs in minute yellowish clots, intermixed with sanious matter. In quantity, it varies from a few ounces to several quarts. In a case mentioned by L'Hermité, a French author, not less than fifteen pounds were found, the sac in which it was contained measuring eighteen inches in length by twelve in breadth; and in the *Memoirs of the Royal Academy of Sciences* a still more remarkable instance is recorded, the quantity of matter amounting to thirty pounds. The coats of the spleen are almost always affected, and, together with the neighboring viscera, are covered with false membranes, which are sometimes perfectly organized. Cases occur in which the whole organ is converted into one great abscess, the sac being either fibrous, cartilaginous, or even bony.

The matter may find its way into the peritonæal cavity, the stomach, colon, or small intestines; or it may burst through the intercostal spaces, the loins, or the walls of the abdomen. Occasionally the spleen contracts adhesions to the diaphragm, and the matter is discharged into the left side of the chest. In this way it may get into the lung, and be finally expelled by coughing.

The symptoms of suppuration of the spleen are frequently very obscure. When the investing membranes remain sound, the pain in the part may be very trifling; but there is always uneasiness in the hypochondriac region, with progressive emaciation and debility. When the suppuration supervenes upon acute splenitis, the suffering is generally of the moist poignant kind, and the formation of matter often takes place very rapidly. In a young, robust farmer, for whom I prescribed several years ago, the pain, which was of a sharp, lancing character, similar to that which accompanies acute pleuritis, continued almost uninterruptedly for nearly two weeks. The spleen gradually augmented in volume, and, at the expiration of the period specified, it projected over towards the umbilicus, forming a large, rounded tumor, between the linea alba and the margin of the ribs. In a short time, fluctuation was perceived, and, on introducing a trocar, about three pints of fetid, dark-colored matter issued from the incision. The wound was kept open for several days, by means of a tent; but in a short period it closed, and from thence on, the patient's health began gradually to improve. This case, decidedly one of the most interesting and instructive on record, supervened upon repeated attacks of intermittent fever, and was characterized by excessive irritability of the stomach, great pain and tenderness, and an impending sense of suffocation, caused, no doubt, by the pressure of the enlarged organ upon the diaphragm.

*Metastatic abscesses* of the spleen, consequent upon surgical operations and external injuries, are of much rarer occurrence than in the lung, liver, and brain. There are also less numerous, but their volume is usually larger, and their contents resemble a clot of blood interspersed with globules of purulent matter. The tissues around the abscesses are usually inflamed, reddened, and sometimes softened.

The termination of splenitis by *gangrene* is a very rare occurrence, notwithstanding the assertion of Portal, that the reverse is the case.\* Morgagni records only two examples of it, in both of which there was a similar lesion of

\* *Anatomie Médicale*, t. v., p. 336, — "La Gangrene de la rate s'observe assez souvent."



the intestines. Modern authors, also, say very little upon the subject, and we have good reason to complain of the neglect with which it has hitherto been treated. The spleen, in this disease, is converted into a soft, diffuent mass, of a brownish, livid, or blackish color, and extremely offensive to the smell.

A much more common effect of inflammatory irritation of the spleen, is a *softening* of its substance, or a conversion of it into a dark-colored, bloody colluvies. The disease is a very frequent attendant on intermittent and typhoid fevers, chronic diarrhœa and dysentery, and affections of the brain and liver. In some countries it is occasionally sporadic, but more ordinarily it is epidemic. The regions most remarkable in this respect are the marshy districts of Italy, Bengal, Denmark, La Vendée, the island of Walcheren, and East Friesland.\* Animals are often affected with it; and it is asserted, though I do not know upon what ground, that it is much more common in women than in men. In softening, the spleen may be enlarged or diminished, or it may retain its normal dimensions; its whole parenchymatous structure is broken down into a soft, blackish mass, not unlike grumous blood, thin tar, or currant jelly, surrounded by thickened and indurated coats. In the more aggravated forms of the complaint, the organ sometimes bursts spontaneously, without any violence on the part of the patient, and the matter escaping into the peritonæal cavity induces fatal inflammation. Occasionally, however, the shell which encloses it is so strong as to prevent this. This was evidently the case with a spleen in my private collection, in which the parenchymatous structure, although perfectly softened, is surrounded by a layer of lymph at least one-fourth of an inch thick.

Of the mode in which this change of structure is effected, nothing more is known than of mollescence in general. Most pathologists, however, concur in the opinion that it results from inflammatory irritation, breaking down the vascular and parenchymatous textures of the viscus by a kind of gangrene. This doctrine derives support from several circumstances, a brief examination of which will not be without interest. In the first place, it may be alleged that the changes here spoken of do not occur all at once, but obtain their perfection by degrees. In the incipient stage of the disease, the spleen is merely injected with dark, dirty-looking blood, and its reticulated structure is not yet very materially altered. Indeed, it is not until the disorder has existed for some time that the organ assumes that black, tar-like aspect which characterizes the softening when it has reached its full development. The disease, secondly, is often accompanied by inflammation of some of the other viscera, and by severe pain in the left hypochondriac region, corresponding to the seat of the spleen. Crendal and Abercrombie relate cases in which it coexisted with pneumonitis; and others refer to examples where it was complicated with lesion of the stomach, liver, pancreas, kidneys, and intestines. In many of the subjects who died of the celebrated Walcheren fever, examined by Wardrop, Vetch, and other physicians, the spleen was greatly enlarged, often weighing from three to five pounds, and reduced to a mere bag, filled with a semi-fluid pulp, not unlike black currant jelly. In the malignant fever of Italy, Sardinia, Bengal, and Hungary, mollescence of this organ is a very common affection; and the same change is generally witnessed in those who die of typhoid fever, in France, England, and America. In the forty-six dissections of the latter Louis found the spleen softened in three-fourths, and in a fifth part of these to such an extent as to be reduced to a pulpy mass with the

\* Hackmann, on Softening of the Spleen, *Medico-Chir. Rev.*, July, 1832.

greatest ease. In the Egyptian plague, the viscus is generally softened, and double its natural volume.\* In the remittent fever of Philadelphia, described by Dr. Gerhard and Dr. Stewardson, this alteration formed a constant and prominent feature. From all these facts, then, it may be justly concluded that mollescence of the spleen is uniformly dependent upon inflammatory irritation, generally of a high grade, though occasionally of a slow, chronic character.

Softening of the spleen, hardly ever observed at a very early period of life, is very common in middle and advanced age. Its progress is often very rapid, reaching its height in the course of four or five days. Occasionally, though rarely, it assumes a chronic form, as in the cases mentioned by Bonetus, Portal, and Hackmann. The symptoms resemble for the most part those of acute splenitis. The precordial distress is often exceedingly great, and is perhaps never entirely absent in any attack of this disease. Towards the last, the patient is harassed with debilitating diarrhoea, vomiting of blood, and hectic fever, dissolution being not unfrequently preceded by a state of coma resembling apoplexy.

The spleen is sometimes *indurated*. This change is generally associated with hypertrophy, and is probably occasioned by chronic irritation, giving rise to congestion of the capillary vessels, and to effusion of lymph into the reticulated texture. The spleen seldom retains its natural color; most commonly it is of a light brownish hue, tears with a granulated surface, and imparts to the finger the same solid feel as the substance of the liver. When these characters are present, the organ is said to be *hepatized*; a phenomenon which is frequently witnessed in this country, in persons who die from the effects of intermittent fever. Induration of the coats of the spleen will be spoken of in another paragraph.

One of the most common affections of the spleen is *hypertrophy*, a state which I have observed in nearly three-fifths of all the examinations I have ever made. It generally occurs in connection with intermittent, remittent and typhoid fevers,† and seems to depend chiefly upon mechanical congestion, exciting ultimately, perhaps, irritative action. That this is probable, is proved by the fact that the spleen is usually more or less indurated, and otherwise changed in its structure. The enlargement is sometimes truly enormous. In many cases the organ is ten or fifteen times the natural size; in an example recorded by Lieutaud, it weighed not less than thirty-three pounds. The patient was an aged female, and the hypertrophy had been gradually progressing for seventeen years. The hypertrophy is sometimes partial, occurring in the form of a tumor, about the size of a walnut or an orange. Of this I have seen several well-marked examples. Some writers, and amongst others Dr. Abercrombie, speak of what they call simple enlargement of the spleen, unaccompanied with derangement of structure: if such a state exists, I have never met with it, and am much disposed to doubt its occurrence. This remark applies of course exclusively to cases of permanent hypertrophy, not to that tumid and erectile condition of the spleen which results from the temporary congestion that occurs during the cold stage of intermittent fever, or from violent emotions of the mind.

The hypertrophy may be of a mixed character, some parts of the spleen ex-

\* Clot-Bey on the Plague in Egypt: British and Foreign Medical Review, vol. i., p. 248.

† Enlargement of the spleen is observed in a very large proportion of those who die of typhoid. Louis and Chemel found the organ preternaturally voluminous in nearly all their cases. In the majority of the patients, it was double the natural dimensions; in others, it was three, four, or even five times the usual size.

hibiting a healthy aspect, whilst others are indurated, broken down in texture, or in a state of suppuration. The coats of the organ are usually hardened, opaque, and thickened, either by interstitial effusion, or by deposits of lymph upon their surface.

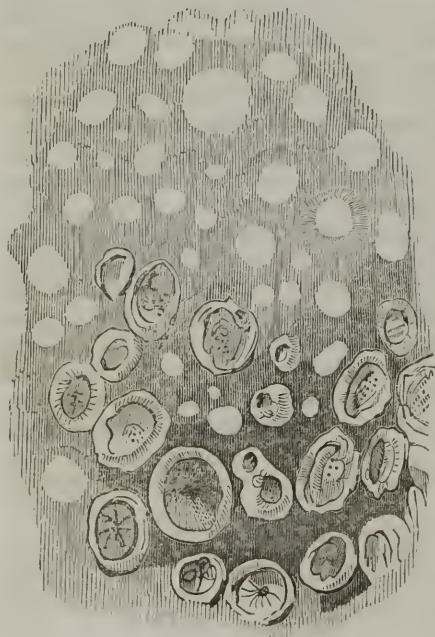
The symptoms of this disease are often remarkably obscure. In many cases they are such as would lead us to believe that the patient is laboring under chronic splenitis; but frequently no other inconvenience is experienced than what results from the increased size and weight of the affected organ. More rarely the symptoms are of an acute character. As the hypertrophy advances, a firm, solid tumor is formed, which projects below the false ribs of the left side, occasionally as far down as the umbilicus, and imparts either a smooth, or notched sensation to the hand applied to the abdomen. In protracted cases, there may be hematemesis, or hemorrhages from various parts of the body, and at last general dropsy.

*Atrophy* of the spleen is by no means so frequent as hypertrophy. Like the latter affection it varies in degree in different cases. The diminution of volume may be very slight, or so great as to give the organ the appearance of being almost annihilated. Professor Dunglison, not long ago, met with a case in which the spleen was reduced to the size of a small almond; Portal refers to one where it was not larger than a nutmeg; and Cruveilhier has seen it scarcely weigh a drachm. In a case which fell under my notice a few years ago, it was hardly as big as a billiard-ball. It was of a greyish color, rounded in figure, indurated, almost bloodless, and weighed only one ounce. Both coats were thickened, and the internal was partially converted into cartilage. The patient, an old man of seventy-two, had died of tubercular phthisis. The atrophy is observed chiefly in connection with chronic affections of the alimentary tube, the liver, and kidneys, with ascites, and with profuse discharges of blood from different parts of the body. The lesion is sometimes partial, and consists

apparently in a removal of the parenchymatous texture of the organ, leaving merely the original fibrous framework.

*Tubercles* are not uncommon in the spleen. I have seen them repeatedly in this organ in children, but only three or four times in the adult, and never in the very aged. In one instance, I met with them in an infant only a few months old; they were very small, solid, and so numerous that the organ was completely crowded with them. Tubercles of the spleen seldom occur in clusters, and, excepting in adults, they do not often acquire a great size. Occasionally, though rarely, they soften, and form numerous small abscesses, filled with thick, curdy matter. These little bodies are not peculiar to the human spleen; Andral has repeatedly found them in the horse, and Reynaud in the monkey. They seldom lead to fatal results, either in man or in animals; and, in the present state

Fig. 178.





of our knowledge, we know of no symptoms which are indicative of their presence. In most cases they exist at the same time in the lungs. When large and numerous, they are apt to excite inflammation in the neighboring portions of the peritonæum, leading to ascitic accumulations. Fig. 178 is a beautiful representation of encysted tubercles of the spleen, from a specimen in the possession of Dr. Bayless. They are of large size, and of a pale yellowish color; some are partially softened, but most are in a crude state.

*Melanism* of the spleen is rare, and I have never seen an example of it. Authors also mention a deposition of fatty substance, as an occasional phenomenon; and encephaloid matter is likewise, I presume, sometimes found. All these lesions are uncommon, and there are no symptoms by which they can be discriminated during life.

The spleen is not unfrequently the seat of *calcareous concretions*; they are always isolated, usually not larger than a grain of mustard, of a rounded shape, and of a whitish, or pale yellowish color. Their number varies from two or three to ten or fifteen. Bonetus mentions a case in which the organ appears to have been literally filled with them. The manner in which these bodies are formed is not well understood. My own opinion, founded upon careful and repeated examination, is, that they are developed in the branches of the splenic vein; from which, as they increase in size, they gradually escape into the parenchymatous substance. This view is countenanced by the fact, that they are often seen in different stages of their formation, as the fibrous, fibro-cartilaginous, cartilaginous, and osseous. The splenic tissue around these concretions is always unchanged.

There is a variety of osseous concretion of the spleen, which occasionally acquires a very large bulk. Its mode of origin is unknown. It is of a pale yellowish color, rounded, oval, or more or less angular in its shape, and either solid, or partly solid and partly porous. In a case mentioned by Morgagni, a concretion of this kind weighed twenty-one drachms, and was arranged in concentric layers. Parallel examples are recorded by Valsalva, Baader, and Bartholin.

A very frequent affection of the spleen is a conversion of its tunics into a substance resembling *fibro-cartilage*. The change generally begins on the convex surface, to which it either remains confined, or gradually spreads over the rest of the organ. The cartilage commonly occurs in small, soft, thin patches, separated by considerable intervals; but, in a few instances, I have seen it quite thick, hard, and occupying a very large extent of surface. This transformation, which may affect one or both tunics, is slow in its progress, and not marked by any special symptoms.

In some rare instances, these coats are transformed into *bony* matter, either in part or entirely. Lithe saw a spleen which was completely ossified; it weighed only one ounce and a half, and was taken from an old man, who died suddenly in good health. A somewhat similar case was seen by Andral. The organ was converted into a mere osseous shell, intersected by numerous bony septa, and filled with a small quantity of thin, reddish fluid, like dirty wine,

*Hydatids* are occasionally found in the spleen. Their origin here is probably the same as in the liver, and they have hitherto been met with chiefly in persons of a cachectic constitution. The substance of the spleen immediately around these bodies is variously affected; in most cases it remains unaltered, but occasionally it is indurated, softened, and even quite pulpy. The hydatids may be simply attached to the surface of the organ, grow between its tunics, or be developed in its parenchymatous structure. Andral has occasionally seen them in the splenic veins, where they either floated about, or adhered by deli-

cate foot-stalks. Hydatids of the spleen cannot be diagnosticated during life. They occasionally attain a large size, and, by bursting into the abdomen, may cause death. Of this an interesting case has been recorded by Dr. Bright, of London.\* A patient, whose age is not stated, having a large tumor in the abdomen, attended with obvious hepatic derangement, became suddenly ill, and died within half an hour. On inspection, the immediate cause of this occurrence was found to be the bursting of a large hydatid in the spleen, by which at least a pint of limpid fluid had been effused into the peritonæal cavity. A similar body existed in the liver; and there were smaller cysts in the kidneys.

*Serous cysts* are sometimes met with in the spleen; they are generally of a globular shape, adhere to the surface of the organ by short, delicate peduncles, and contain a clear, limpid fluid, like spring-water. Such vesicles I have seen in quite a number of instances. They rarely attain much magnitude, their mode of origin is very obscure, and in some cases they are occupied by a sort of meliceric, atheromatous, or steatomatous substance. No symptoms accompany these lesions, that can be considered as in the slightest degree pathognomonic.

The spleen may be affected with internal hemorrhage, so nearly resembling that of the brain that M. Cruveilhier,† by whom this lesion was first accurately described, has been induced to designate it by the term *apoplexy*. The blood is deposited at one or more points, commonly of a rounded shape, and of variable size, and is evidently the result of a laceration of some of the branches of the splenic vessels. When the hemorrhage is connected with softening of the organ, the fluid may accumulate in large clots, or it may burst the coverings of the spleen, and escape into the peritonæal sac. The changes which the apoplectic deposits exhibit are of the same nature as under similar circumstances in the brain and other organs. This malady is not uncommon in some of the inferior animals. In the horse and cow it often proves fatal in the course of a few hours, the quantity of blood poured out amounting perhaps to several gallons. It is now well ascertained that ossification of the splenic artery is a very frequent lesion in old age; and it is not improbable that this state of the vessel is the principal cause of the internal hemorrhage. This opinion, at all events, is plausible. Similar results, we know, often follow ossification of the cerebral arteries; and if this lesion exists in the spleen, we have only to suppose that the individual would have to expose himself to great exertion to bring about the same phenomenon.

The spleen, owing to its soft, brittle texture, is liable to *laceration* from external violence, as a blow, a kick, a fall, or the passage of a carriage-wheel. In such cases, of which a great many are referred to by Portal, Voigtel and other authors, the individual usually expires in a short time from hemorrhage, or from the shock to the nervous system. Occasionally, indeed, death occurs in a few minutes, or almost instantaneously. The rent, which may be single or multiple, oblique, transverse, or longitudinal, often extends from one surface, one edge, or one extremity to the other, and when it involves the splenic artery or some of its primitive divisions, it is always followed by copious hemorrhage, amounting sometimes to many pounds. Tulpe, Bohn, Alberti, and Schaarschmidt, all relate cases of rupture of the spleen from injury inflicted upon the left hypochondriac region with a cane or stick; in Rust's Magazine is one where the accident was produced by a man striking his wife with a long

\* Guy's Hospital Reports, vol. ii., p. 469.

† Dict. de Med. et Chir. Pratiques, t. i., p. 296.

elastic switch; Daniel gives one where it was caused by a spade; Scheid, Rebsamen, and Pyl mention examples from the passage of the wheel of a cart or carriage; and instances from falls, and the kick of a horse or even of the human subject, are recorded by a great number of authors. In the first volume of the Medical Commentaries of St. Petersburg is a case of laceration of the spleen from a blow of the fist; and another where the accident was produced by a blow on the stomach is related by Mr. Henner in his Principles of Military Surgery. The organ in this case was perfectly healthy, not in the least enlarged, though a little firmer than it is generally found, and was ruptured from its lower to its upper margin, to the extent of four inches. The splenic vein was torn, and the peritonæal cavity contained from six to seven pounds of dark-colored, fluid blood. Dr. W. B. Herrick has recorded, in the first volume of the Illinois Medical Journal, a case of rupture of the spleen from a blow of the fist on the left hypochondriac region. The organ was enlarged to about five times the natural dimensions, and so soft in texture as to break down under the slightest pressure of the finger. The rent was five inches long, and extended into the very centre of the viscus. The quantity of extravasated blood amounted to between two and three quarts.

When the spleen is very soft and pulpy, it may be ruptured from the most trifling causes, as an inadvertent movement of the body, violent straining, or inordinate contraction of the abdominal muscles. Of this occurrence, which, however, is extremely rare, examples are mentioned by Lieutaud, Schaaarschmidt, Morgagni, and Voigtel. In 1842 an instance was published by Dr. John Neill,\* of Philadelphia, and about the same period another was reported in a French periodical, the "*Journal des Connaissances Medico-Chirurgicales*." In the former, the spleen was of the natural form and shape, but exceedingly soft, and of a very dark color; the rupture was confined to the peritonæal covering of the organ, and the abdominal cavity was filled with blood, partly fluid, and partly coagulated. The subject was a black seaman, forty-two years of age. In the other case, that of an old soldier, the spleen was enormously enlarged, and presented on its anterior surface a rent two inches long by twelve lines in breadth. Death occurred soon after the accident, which was followed by an immense effusion of blood into the peritonæal cavity.

## CHAPTER XXIV.

### OF THE PANCREAS.

Situation and Organization. — Weight and Dimensions. — Color. — Has no special Envelope. — Is liable to pretty much the same Diseases as the Salivary Glands. — Rarely the Seat of Acute Inflammation. — Atrophy. — Hypertrophy. — Is sometimes affected with Scirrhus. — Encephaloid. — Melanosis. — Fatty Transformation. — Serosus Cysts. — Tubercular Deposits. — Sanguineous Effusion.

THE pancreas, situated deeply in the abdominal cavity, is stretched horizontally across the vertebral column, the aorta, and great hollow vein, being concealed by the stomach and the arch of the colon, and extending from the spleen to the second portion of the duodenum, the latter of which it closely embraces. In its structure it bears the strongest resemblance to the salivary glands, being composed of numerous lobules and granules, which are of a faint

\* American Journal of the Med. Sciences, N. S., vol. iv., p. 369.



pink color, firm in their consistence, and connected together by dense cellular substance. It is of an irregularly elongated form, slightly convex in front, and nearly flat behind; the inferior margin is rounded, and the superior is grooved for the lodgement of the splenic vessels. Its dimensions, for about two-thirds of its extent, are nearly uniform; after which it becomes remarkably contracted, but soon expands again, so as to constitute what is called the head of the pancreas, or that part which adheres to the small bowel.

The size of the pancreas varies in different individuals and in the different periods of life. In six examinations of the healthy adult organ I found the following as the mean weight and dimensions. Weight,  $2\frac{1}{2}$  ounces; length, 7 inches; breadth at the body and splenic extremity,  $16\frac{1}{2}$  lines; at the neck, 12 lines, and at the head 2 inches and three lines: thickness at the body, neck, and splenic extremity, 4 lines, and at the head, 8 lines. In thirty-two examinations by Bécourt,\* the average length was eight inches; and the weight between 3 and 4 ounces.

The color of this organ varies somewhat in the different periods of life. In children it is of a rosaceous tint, in the adult it is a shade or two lighter, and in old age it commonly exhibits a pale yellowish appearance. Its consistence, considered in reference to the different stages of our existence, does not appear to be liable to much diversity.

The pancreas has no distinct envelope, unless we consider as such the delicate film of cellular substance which is spread over its exterior. Its excretory duct, which extends the whole length of the gland, is about the size of a crow-quill, and opens at an acute angle into the duodenum, either alone, or, as is more commonly the case, conjointly with the choledoch duct. The canal is almost always single; sometimes, however, there are two or even three. In one instance I found it enlarged to the size of a goose-quill, and filled with thick, whitish mucus, from a partial closure of its orifice. The nerves of the pancreas are derived from the solar plexus. Its vessels are numerous, but small.

There is much variety in the different organs of the body, with regard to their susceptibility of being excited to disease. Amongst these, there is none, except, perhaps, the thymus gland, which is less frequently affected than the pancreas. This exemption from derangement may probably be owing, certainly in part, to the singular structure of this viscus, to its concealed situation, and to the absence of everything like a proper envelope. Occasionally it is attacked with inflammation, originating either in its substance, or propagated to it from the surrounding organs, especially the duodenum, the lining membrane of which, as before stated, is reflected into its interior along the rootlets of its excretory duct. In the acute form of this disease, the pancreas is of a light reddish color, and the interlobular tissue is infiltrated with serosity, by which the glandular texture is rendered unusually distinct. When the inflammation is violent, the color becomes more deep, not unfrequently of a brownish mahogany tint, and the proper substance of the organ undergoes such a degree of softening that it may be readily torn.

Although acute pancreatitis generally terminates by resolution, yet cases occasionally occur where it passes into the chronic form, or leads to suppuration. The matter, as in the other viscera, may be diffused through the interlobular cellular tissue, or be collected into an abscess. In the former case, the pancreas is generally very soft, and its glandular structure of a reddish grey color;

\* *Recherches sur le Pancreas*, Thèse, Strasbourg, 1830. See, also, Dr. Dunglison, *Human Physiology*, vol. ii., p. 264. Philad. 1844.

in the latter, a portion of the organ is usually broken down, and the matter ultimately bursts into the adjacent reservoirs, as the stomach, arch of the colon, or duodenum. In some instances, it escapes into the cellular tissue of the mesocolon, where it is either absorbed or erodes the lamina of this fold, and makes its way into the abdominal cavity. In a case mentioned by Gendrin, the abscess opened into the jejunum, and the gland was converted into a hard, reddish, friable mass, the interior of which was filled with drab-colored, fetid pus. I am not aware of any instance where the matter thus collected, discharged itself into the aorta or vena cava; but I can readily conceive of the possibility of such an occurrence. The fluid is sometimes contained in a strong pouch, formed by the condensation of the surrounding cellular tissue, either alone, or aided by a deposition of fibrin.

There is considerable diversity in relation to the nature and consistence of the purulent matter. Most commonly it is thick, yellowish, and inodorous, as in healthy suppuration of other parts. In other cases, however, it is very thin, sanious, greenish, curdy, and highly offensive. The quantity of pus seldom exceeds a few ounces. In an example recorded by Portal, the abscess contained upwards of two pounds.

Acute inflammation and suppuration of this organ are generally associated with disease of some of the other viscera. In a case reported by Portal, the patient had labored for some time under violent paroxysms of gout in the feet, and suddenly expired during an attack of vomiting. In other instances we find it to have been connected with continued and intermittent fevers, chronic diarrhœa, dropsy, epilepsy, and disease of the liver and spleen. In several cases recorded by Anthony Petit, the suppuration would seem to have supervened upon the extirpation of the testicle, with ligature of the spermatic cord; a circumstance which induced that celebrated surgeon to write a memoir against the propriety of using the ligature in such operations. In a gentleman, who was attended by Dr. Percival, of England, and whose pancreas was much enlarged, and contained a considerable abscess, there was a distinct tumor in the epigastric region, with jaundice and bilious vomiting, a gradual failure of strength, and frequent discharges of bloody and fetid pus from the bowels. On the whole, we are unable to point out any particular symptoms or series of phenomena that indicate the existence of this disease during life.

In regard to *softening* of the pancreas, our knowledge is extremely limited and imperfect. The disease, which is marked by the usual anatomical characters, has hitherto been observed chiefly in persons that have died of scurvy, small-pox, scrofula, and measles. In two children who succumbed under the latter malady, Portal found the pancreas remarkably softened, without any alteration of color or increase of volume.

Acute pancreatitis, especially when it supervenes on the chronic form of the disease, may end in *gangrene*. Of this termination, instances are related by Greisel, Portal, and other respectable authorities. In the case mentioned by the first of these writers, the whole organ seems to have been sphacelated, as well as the parts immediately around it. Indeed, violent inflammation of the surrounding viscera is one of the most common complications of gangrene of the pancreas. When this event has taken place, the substance of the pancreas is of a dark livid color, greatly softened, and exudes a blackish, fetid fluid on pressure, like mortified structures in other situations.

Chronic inflammation is no doubt much more frequent than the form of the disease which we have just been considering. Under the influence of this disorder, the pancreas becomes hard, firm, crisp, and of a dull reddish color, at the same time that it augments considerably in volume, from the interstitial

deposition of lymph. This increase of size, however, is far from being a constant phenomenon. Indeed, I am inclined to believe that, in very many cases, the organ experiences a real diminution, its lobules and granules becoming more closely aggregated than they are in the normal state. When the irritation is protracted, the pancreas often assumes a pale greyish aspect, and a hard, almost gristly, consistence.

*Atrophy* of the pancreas is sometimes congenital, but most commonly it is induced by compression of some of the neighboring viscera, as an enlarged spleen, a scirrhus duodenum, or a hypertrophied liver. It may likewise be caused by enlargement of the right kidney, or a mass of diseased lymphatic ganglions. Berjaud saw a case in which the wasting was occasioned by the pressure of a large aneurism of the ventral aorta. It might also result, I should suppose, from the contraction or partial obliteration of the splenic artery, interrupting the nutritive function of the component tissues of the organ. Siebold and Lobstein have described a species of senile atrophy, in which the pancreas, in common with the salivary and other glandular viscera, loses its natural consistence, and is more or less reduced in volume, as an effect purely of old age.

The color and consistence of the affected organ may be natural, diminished, or increased. In a majority of cases the color is quite pale, from the diminished supply of blood, and the granular texture is unusually firm, from the absence of serosity and the condensation of the connecting cellular substance. The extent of the atrophy is extremely variable. It may be limited to one-fourth, or one-half of the gland, or pervade the entire organ. In a case of the latter description which I had an opportunity of observing, several years ago, in a young female who died of chronic hepatitis, attended with peritonæal effusion, the pancreas was scarcely four inches in length by eight lines in width, and did not weigh more than an ounce and a half: its substance was of a pale greyish color, as well as remarkably soft, and the excretory duct was nearly obliterated. Similar examples are recorded by Morgagni, Guérin, Lobstein, and other authors.

Enlargement of the pancreas, constituting what is termed *hypertrophy*, is probably still more uncommon than a diminution of bulk of this organ. My own dissections, at all events, have furnished me with very few cases of it; nor are many instances of it to be found in the writings of pathologists. "Enlargement of the pancreas," says Professor Carswell,\* "from irritation or chronic inflammation is extremely rare, or rather has not perhaps been established as a pathological fact." The best examples of this disease that I have met with were connected with scirrhus of the pyloric extremity of the stomach, and were evidently produced by an extension of the morbid action along the pancreatic duct. In one case the lesion was associated with great enlargement of the liver, and in another it was evidently dependent upon caries of the spine and ulceration of the intervertebral fibro-cartilages.

The increase of dimensions is seldom very considerable, though the organ may be double, triple, or even quadruple the natural size. The granular texture is remarkably close, firm, and intersected by opaque membranous bands, not unlike those of scirrhus. The connecting cellular substance is very much condensed, and the gland is almost entirely deprived of moisture. The color may be natural, or even augmented, but in most cases it is diminished, the hypertrophied part having a white and glossy appearance. The enlargement is most common in the duodenal extremity of the pancreas, but may affect any portion. When the hypertrophy is very considerable, some of the rootlets of

\* Pathological Anatomy, article Hypertrophy.



the excretory duct are apt to be compressed by the indurated granules, leading to retention of the natural secretion, and to the formation of small cysts, filled with a turbid, viscid, reddish fluid.

*Scirrhus* of the pancreas may affect the entire gland, or be limited to particular sections of it, separated by parts which retain their normal structure and appearance. The portion more frequently implicated than any other is the head or hepatic extremity. The diseased structure is usually of a whitish, greyish, or pale drab color, and of a dense, fibrous, or gristly consistence, emitting a grating noise when cut. In the more advanced stages, the granular texture is completely effaced, and the morbid mass is intersected by whitish or bluish bands, so characteristic of scirrhus in other glandular organs, as the mamma and testis. Now and then there is a singularly mixed state of disease, some parts being almost as hard as cartilage, others quite soft, and composed of alternate strata of white and yellowish matter.\*

This disease frequently coexists with scirrhus of other parts of the body, particularly the stomach, duodenum, and liver. The pancreas may retain its natural form and bulk, or it may, as, in fact, it most generally is, be irregularly lobulated, and enlarged. The increase of size varies from a few lines to several inches, and may be so great as to equal the volume of a large fist. When the disease is chiefly confined to the round extremity of the pancreas, the enlarged part may compress the duodenum and choledoch duct, impeding, on the one hand, the passage of the food, and, on the other, the flow of the bile. The stomach may also be injuriously encroached upon, and in a case mentioned by Andral, the tumor produced great suffering by the pressure which it exerted on the aorta and the surrounding nerves. When the common gall-duct is obliterated, and the biliary fluid retained, extensive disorganization of the liver may be the result. The pancreatic canal itself may remain pervious, or it may be closed, and rendered turgid from retained secretion.

When the patient survives the effects of this disease for several years, ulceration may take place, and thus a communication may be established between the tumor and some of the adjacent viscera, as the stomach, duodenum, or arch of the colon. In such cases life is sometimes destroyed, either suddenly or gradually, by hemorrhage from the perforation of a bloodvessel. Mabillet† relates an instance, where, upon a careful examination of the ulcerated portion of the pancreas, the splenic artery was found extensively denuded, very thin, and ruptured at two distinct points.

Scirrhus of this organ is most common in old subjects, though it has been observed as early as the thirtieth year, and, in one case, recorded by Cruveilhier,‡ in a child that died immediately after birth. Whether it occurs with equal frequency in both sexes has not been ascertained.

Of *encephaloid* disease of the pancreas I have never seen an example, but cases of it have been reported by Abercrombie,§ Syme,|| Bright,¶ Duponchel,\*\* Meriadec Laennec,†† Vidal,‡‡ and other pathologists. Although it has been noticed as early as the sixteenth year, it is most common after the age of forty, and, like scirrhus, may appear simultaneously or successively in other organs.

\* Abercrombie on Diseases of the Stomach, p. 413. Phila. 1830.

† Recherches sur certaines lésions organiques de l'estomac, p. 20. Paris, 1822.

‡ Anatomie Pathologique, t. i., livr. xv.

§ Diseases of the Stomach, p. 412.

|| Edinb. Med. and Surgical Jour., vol. 44, p. 125.

¶ London Medic-Chir. Trans., vol. 18, p. 1.

\*\* Bull. de la Soc. d'emulat. de Paris, 1824, p. 76.

†† Revue Médicale, 1824, t. iii.

‡‡ Nouvelle Biblioth. Méd., t. vi., p. 101.

The tumor varies in size from a cherry to that of a full-grown foetal head, and exhibits the usual pale yellow, pulpy, and brain-like character of encephaloid in other situations. In the early stage of the disease the tuberoid nature of the tumor is well-marked, but as the quantity of the heterologous matter increases, the pre-existing structures are changed, and ultimately entirely disappear. When ulceration occurs it pursues very much the same course as in scirrhus, that is, the erosive process extends to the stomach or bowels, and the patient is sometimes cut off by hemorrhage, as in the interesting case recorded by Vidal.

There are no symptoms, unfortunately, which can be regarded as pathognomonic of scirrhus and encephaloid of the pancreas. In most cases, the phenomena are such as indicate a deranged state of the digestive apparatus. The pain, which is occasionally quite acute, is commonly of a dull, aching character, shooting along the spine, and augmented by pressure; often there is great irritability of the stomach, so that the individual retains his food with difficulty; and, in some instances, there is deep jaundice, arising probably from the enlarged and indurated mass choking up the biliary ducts. When the tumor is considerable, it can be readily felt in the epigastric region, and, by compressing the nerves of the abdomen, frequently gives rise to pain in the hips, and numbness of the lower extremities. The outline of the swelling will be most distinct when the stomach is empty, and the examination, in order to be satisfactory, should always be made during this state.

Examples of *melanosis* of the pancreas have been observed by Haller,\* Gohier,† Fawcington,‡ and Norris.§ The disease is exceedingly infrequent, and usually coexists with similar deposits in other parts of the body.

Of *serous cysts*, as occurring in the substance of this gland, very little is known. Indeed, there are only two cases of this disease of which I have any knowledge. One of these has been recently published by Dr. Bécourt, a French physician. The tumor, which is contained in the medical museum of Strasburgh, is fully as large as the head of a child four years old, and is composed of very strong, fibrous walls, the twelfth of an inch in thickness. The other case came under the observation of Dr. Duponchel, in the military hospital at Cadiz. The cyst, in this instance, was somewhat smaller, and had entirely supplanted the pancreas, not a vestige of which remained. It had thick, dense parietes, and was occupied with a brownish, bloody-looking matter, not unlike the grey substance of the brain.||

The pancreas seems to be susceptible of the *adipous* degeneration. Examples of this lesion have been reported by Dupuyten, Bécourt, and Lobstein, the latter of whom has delineated a specimen of it in his plates of morbid anatomy. When the pancreas is thus affected, it is of a pale yellowish color, more or less soft, indistinctly lobulated, and readily greases the scalpel. Its size is usually augmented, but its vessels are preternaturally small and brittle. This degeneration is extremely rare, and the causes which give rise to it are still involved in obscurity.

Of the extreme infrequency of tubercle of this organ some idea may be formed, when it is stated, that of three hundred and fourteen scrofulous children, examined by Rilliet and Barthez, the disease was not observed in a single one. Carswell declares he has never seen the deposit in the human subject, and

\* Disp. Med., t. iii., p. 513.

† Mém. sur la Chir. et Méd. vétérinaires, 1813.

‡ Case of Melanosis, London, 1826.

§ Medico-Chirurg. Review, Oct. 1836.

|| Bul. de la Soc. Méd. d'Emul., Mars, 1824.

only once in the monkey. Louis does not seem to have met with it in his numerous dissections of phthisical subjects. On the other, Lombard witnessed the disease not less than five times in one hundred scrofulous children. In an interesting case recorded by Mr. Mayo, the pancreas was partially infiltrated with tubercular matter, which was converted, in some places, into thick pus. Similar deposits were observed in one or two of the mesenteric ganglions, in the kidneys, and in the thymus gland. In an instance which came under my own notice, the head of the pancreas contained nearly a dozen tubercles, of a spherical shape, whitish in their appearance, and of a firm, solid consistence. The subject was a negro boy, between eight and nine years of age, who died of pulmonary phthisis.

Suet, atheromatous, and meliceric substances were observed in the pancreas; but their occurrence is extremely rare, and I have never met with an instance. In the body of a man forty years old, Portal found the organ immensely enlarged, and full of steatomatous masses. It had a coating, of the consistence of suet, about half an inch thick. Similar concretions existed in the mesenteric ganglions.

*Apoplexy* of the pancreas is almost unknown. The whole of my reading has supplied me with only one example, the particulars of which have been detailed by Dr. Roberts in the fourth number of the "Bulletin de la Société Anatomique." The subject was a female who was affected with a hemorrhagic diathesis, and who died on the twelfth day of her illness, having labored all along under violent oppression of the chest attended with copious expectoration of blood. Apoplectic depôts were found, not only in the pancreas, but in nearly every organ of the body, even to the kidney, ovary, mammary gland, and omentum.

A very interesting and unique case of *internal hemorrhage* of this organ has been recorded by Storck, in his *Annus Medicus*. The pancreas weighed thirteen pounds, and was converted into a membranous sac, full of blood, partly grumous, and partly lamellated and organized. The probability is, that this immense effusion was caused by the rupture of an enlarged vessel in the interior of the diseased gland. The subject, a female, aged twenty-four years, had frequent fainting fits, with great anxiety, and palpitation in the region of the heart, and was finally carried off, after a period of three months and a half, by an attack of bilious vomiting and diarrhœa. A large, heavy, and irregular tumor had been latterly observed in the epigastrium.

The pancreas, from the firmness of its structure, and the thickness of the parts by which it is covered, appears to be less liable to *laceration* from external violence than any other abdominal organ. There is, in fact, at least so far as my knowledge extends, but one case of the kind on record, namely, that related by Mr. Travers, in the twelfth volume of the London Lancet. It occurred in a woman, who, while in a state of intoxication, was struck by the wheel of a stage-coach, which fractured several of her ribs, and in a few hours caused her death. Both the pancreas and liver were ruptured, the former completely across, and a large quantity of blood was effused into the peritonæal sac.

The duct of the pancreas, like that of the liver and gall-bladder, is liable to be choked up with tubercular matter, chalky powder, and earthy concretions. The latter vary in size between a small pea and a nutmeg, are of a whitish color, hard, friable, and of a spherical shape, with a rough, irregular surface. They are easily dissolved by muriatic acid, and are composed chiefly of carbonate of lime, in combination with a minute quantity of animal matter. The number of these concretions is sometimes considerable, as many



as a dozen having been found in a single subject. We are not acquainted with any symptoms which may be considered as indicating the presence of these bodies. It may be imagined that, when large, rough, or numerous, they would occasion a good deal of pain and irritation, together with gastric distress. But these phenomena would not be characteristic, as they could not be distinguished from those which attend disease of the neighboring organs.

## CHAPTER XXV.

### OF THE URINARY APPARATUS.

#### SECTION I.

##### OF THE SUPRA-RENAL CAPSULES.

I. *Supra-renal Capsules.*—Their Structure and Diseases enveloped in obscurity.—II. *The Kidneys.*—Observations on their Normal Characters and Congenital Vices.—Lesions of their Fibrous Covering.—Pyelitis, Acute and Chronic.—Nephritis, Acute and Chronic.—Abscesses.—Softening.—Induration.—Gangrene seldom or never observed.—Bright's Disease.—Scirrhus and Encephaloid.—Tubercles.—Melanosis.—Erectile Tissues.—Serous Cysts.—Hydatids.—Fibro-Cartilaginous, Osseous, and Fatty Degenerations.—Enlargement and Atrophy.—Rupture.—Renal Calculi.—The Strongylus.—III. *The Ureter.*—Liable to Deposits of Tubercular Matter.—Effusion of Lymph, Thickening and Attenuation of its Parietes, with Contraction or Enlargement of its Cavity.—IV. *The Urinary Bladder.*—Is rarely affected with acute Inflammation, Suppuration, Softening, or Gangrene.—Hypertrophy of the Mucous and Muscular Tunics.—Development of Cysts.—Ulceration.—Encephaloid Disease.—Tubercle.—Neuralgia.—Rupture.—Worms.—Calculus Concretions.—Healthy and Morbid Urine.—Kiestine.—V. *The Prostate Gland.*—Situation, Weight, and Volume.—Is liable to various forms of Disease, especially to Enlargement.

THE supra-renal capsule, situated at the upper extremity of the kidney, is seldom found diseased. In the adult it is always much smaller, relatively speaking, than in the infant, in whom it probably performs a very important function, though what that function is we are still ignorant of. As life advances, this body gradually diminishes in size, becomes indurated, brittle, and assumes a peculiar dark color. These changes, which I have frequently noticed in young persons, are generally very conspicuous in old age. The atrophy is sometimes very great, the organ scarcely retaining a vestige of its original shape and structure.

In a few instances, I have seen the supra-renal capsule very red, injected, and softened, without, however, being able to satisfy myself that it was inflamed. This disease, I suppose, rarely exists independently; in most cases, it is no doubt propagated to it from the kidney or some other organ. Abscesses have been known to form in this viscus. Such an appearance has never come under my own observation, and I am persuaded is extremely rare. Blasius\* mentions the case of a woman, fifty years of age, in whom the left supra-renal capsule was as big as the fist, soft, reddish, and filled with black purulent matter, mixed with sand and gravel; and Lieutaud† has recorded an instance in which this organ contained two pounds of pus. The same author refers to the case of a boy of two months, whose supra-renal capsule was larger than a pigeon's egg, and distended with a fluid like the blackest ink.

\* Observ. Anat., p. 129.

† Hist. Anat. Méd., t. i., p. 357.

Rayer asserts that the most frequent alteration of the supra-renal capsule is *hemorrhage*; but this is probably an error, as I have never met with an instance in the examination of several hundred subjects, while I have several times noticed other affections. The blood, which varies in quantity from a few drachms to several ounces, is red and fluid, black and coagulated, yellowish and firm, according to the length of time that has elapsed since it was effused, and is generally contained in one or more pouches, the walls of which are often quite tough and thick. The hemorrhage may occur at any period of life. It has been noticed in new-born infants, and in persons after the sixtieth year.

Earthy concretions have occasionally occurred in the supra-renal capsule, and in a few rare instances it has been observed to be changed into a substance like cartilage. Baillie once saw tubercles in this organ, and two cases of a similar kind have come under my own notice. In one of these, a young man twenty-seven years of age, the right supra-renal capsule was remarkably hard, dense, of a greyish mottled aspect, and filled with concrete tubercles, many of which were quite large. The left capsule was of a light slate color, and likewise contained several scrofulous deposits.\* In the other instance, that of a child of fifteen months, the disease was connected with pulmonary phthisis, and consisted of a large yellowish mass, of the consistence of soft putty. In both these cases, the affected organs appeared to be of the natural size.

The two forms of carcinoma termed encephaloid and melanosis scarcely ever attack the supra-renal capsule. I have never met with either, and the only instances that I know of are those related by Rayer.† In one of these the two affections coexisted in the skin, lung, liver, heart, kidney, ovary and muscles, in small disseminated masses; in the other, the cancerous organ was of the volume of a flattened orange, and exhibited the characteristic features of encephaloid. The same writer has delineated a case of scirrhus, the only one of which I have any knowledge.

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## SECTION II.

### OF THE KIDNEYS.

The kidneys are two glandular organs, whose office it is to secrete the urine, and assist in depurating the blood. Situated deeply in the lumbar regions, a little exterior to the spinal column, they are five inches in length, three in breadth, and one and a third in thickness, their weight being usually about five ounces. These statements comprise the average results of twelve examinations, made with the view of determining the standard bulk of the kidney. But, it should be observed, that there is no organ, excepting the spleen, which is so liable to variation. Hence the weight of a healthy kidney may range from four to eight ounces, its length from four to six inches, its breadth from two and a half to three, and its thickness from one to one and three-quarters.

The color of these organs is of a reddish brown, not unlike that of the muscles, and their parenchymatous structure is harder and denser than that of any other glandular viscus in the body. Such, indeed, is their fragility,

\* See Western Journal of the Medical and Physical Sciences, vol. xi., p. 21.

† *Traité des Mal. des Reins*, Pl. lvi., Fig. 4 and 7.

that they are very easily ruptured by external violence, applied either directly to the lumbar region, or communicated to them in the form of a general shock. The kidneys are sometimes remarkably pale, in consequence of extreme emaciation of the system, from protracted and painful maladies of the other viscera; and not unfrequently they are of a dark purple color, and greatly loaded with blood, from congestive stagnation of this fluid in the capillary vessels. These phenomena should not be mistaken for those of disease of the renal tissues.

The kidney is enveloped by a thin fibrous capsule, which is loosely connected to its exterior by short cellular substance. On making a section of the organ, it will be found to be composed of two substances, differing from each other in color, situation, structure, and function. Of these, the exterior is essentially vascular, being made up of the ultimate ramifications of the renal artery and vein; and it is in this portion of the kidney that is secreted the urine. It is of a soft glandular consistence, of a red dusky color, and about two lines in thickness. Occupying the exterior of the viscus, it is in contact, on the one hand, with the fibrous capsule, and sends off prolongations on the other, which extend between the cones of the tubercular texture, and thus insulate them from each other. Thickly scattered through this substance are small granulations, not larger than a pin-head, which are supposed by Malpighi to be hollow, but the precise nature of which is still undetermined.

The other substance is of a rose tint, inclining to greyish, its color being usually a few shades lighter than that of the vascular structure, by which it is surrounded. It is arranged in the form of cones, of which there are, on an average, about ten in each kidney. The substance of these bodies is essentially tubular, being composed of an immense number of the most delicate canals, which give the part, when torn, a striated fibrous arrangement. The office of these canals is to convey the urine into the calyces of the kidney as fast as it is secreted by the vascular texture; and they are all lined by a prolongation of the mucous membrane of the ureter.

The kidney receives an immense supply of blood through the renal artery, more so, in proportion to its size, than any other organ in the body. Its nerves, which are derived from the solar plexus and from the small splanchnic, are also extremely numerous, and establish important sympathetic relations with all the other viscera, especially with the stomach, brain, urinary bladder, testicles, and penis. A little attention to the distribution and relation of these nerves will enable us to comprehend the sympathetic irritations which so frequently accompany the diseases of the renal tissues.

Considerable variety is observed in regard to the original conformation and situation of the kidney. No well authenticated case has yet been recorded, I believe, of the complete absence of both these organs in the adult. Dr. Klein, a German physician, has, it is true, reported an example of this kind; but his account is too loose and unsatisfactory to be entitled to implicit confidence. Nor is it at all common to find one of the kidneys wanting. In all my dissections, I have never met with an instance, and Andral seems to have noticed only two. When this anomaly exists, the other kidney is generally unnaturally large, to compensate for the deficiency.

It is not rare to see one of these viscera in front of the spinal column, or in the cavity of the pelvis, the other occupying its usual situation. Cruveilhier states that he has several times observed the right kidney very low down in the corresponding iliac fossa, in women who had been in the habit of wearing tight corsets. The renal organs are sometimes joined together by a



narrow isthmus. When this is the case, they lie close to the vertebræ, forming a kind of arch, with the concavity directed towards the diaphragm. They are more compressed than usual, the fissure is absent, and the vessels enter lower down, generally at the anterior surface. The situation of the ureter is likewise different.

Instances have been recorded of individuals who had three kidneys. In these cases, either two of the organs were on the same side, or they occupied their usual place, whilst the supernumerary one was situated in front of the spine, or within the pelvic cavity.

I. The *fibrous capsule* of the kidney is seldom implicated in disease. Dr. Baillie remarks that he has never seen it under acute inflammation, and the same is the result of my own dissections of several hundred subjects. The reason why this affection so seldom occurs in this structure, probably is, that it has no connection with the peritonæum, as is the case, for example, with the spleen and liver, the envelopes of which, as is well known, are very prone to inflammation. Another reason, no doubt, is the fact that this membrane sends no processes into the glandular structure of the organ, the attachment between it and the outer surface of the kidney being effected by very short cellular tissue, which, we may suppose, rather prevents than admits of the propagation of diseased action from the one to the other. When inflamed, this membrane will exhibit the same anatomical characters that are found, under similar circumstances, in the other viscera.

In tubercular and scirrhus disease of the kidney, I have found the fibrous capsule, in several instances, very much thickened, opaque, preternaturally strong, and covered with patches of organized lymph. In the fatty degeneration, it is sometimes remarkably attenuated, and hangs almost loose around the organ, from the destruction of the connecting cellular tissue. Portal states that he has seen the capsule of the kidney partly ossified; and cases are recorded by Bonetus, Morgagni, and Voigtel, where it was converted into a substance like cartilage. Not unfrequently it is glued to the surrounding organs by thick masses of lymph.

II. When the inflammation attacks the mucous membrane of the pelvis and calyces, it constitutes what is called *pyelitis*. To Mons. Rayer is due the merit of having been the first to draw attention, in a decided manner, to this disease, which had been either overlooked or only cursorily glanced at by other pathologists. Pyelitis occurs at different periods of life, is induced by various causes, and is usually associated with an albuminous state of the urine. It may affect the entire pelvis, or be limited to a particular part of it, or even to a single calyx. The disease may exist simultaneously in both kidneys.

The anatomical characters of the acute pyelitis, are, increased vascularity, effusion of lymph or pus, opacity, softening, and alteration of the natural secretion.

In the milder grades of the disease the vascularity of the mucous membrane is of an arborescent character; but as the morbid action advances, the vessels exhibit a capilliform arrangement, and are so much distended as to give the part a tumid appearance. The discoloration varies from the slightest rose to the deepest purple, and is always in direct proportion to the intensity of the inflammation. Although it is sometimes spread over a considerable extent, it usually occurs in small, irregular patches, separated by narrow strips of sound membrane. In their size these patches range from a split pea to a dime; in their form they may be circular, oval, linear, or angular. When the inflammation is very high, the redness may not only be very intense, but

is apt to be widely diffused. Minute spots, not larger generally than the head of a pin or a hempseed, are often observed, either in the substance of the membrane or in the submucous cellular tissue; they are evidently produced by the rupture of the capillary vessels, and constitute so many real ecchymoses. Connected with this augmented vascularity are more or less opacity, softening, and deposition of lymph, in small, whitish, circumscribed spots, or in the form of a distinct lamella moulded to the shape of the cavity in which it is located. When the disease extends to the parenchymatous structure, it is not unusual to find serosity or pus in the submucous cellular substance. Ulceration, gangrene, and perforation are exceedingly infrequent.

When the morbid action is severe, the urine contained in the pelvis and calyces is invariably mingled with muco-purulent matter, pure pus, or even pure blood. The presence of these adventitious fluids is not always visible to the naked eye, but may be easily detected with the microscope. In a small proportion of cases we find crystals of uric acid, ammoniaco-magnesian phosphates, albumen, and other deposits.

In *chronic pyelitis*, the mucous membrane is of a greyish, dull-white, mottled, brownish, light slate, or pale mahogany tint, or entirely free from discoloration of any kind. It is opaque, thicker, and tougher than in the healthy state, rough, and incrustated with plastic lymph, which is generally organized, and firmly adherent to the surface on which it rests. In protracted cases, the excretory tubes are more or less dilated, and the veins on the surface of the kidney are enlarged, tortuous, and so arranged as to form a network. The kidney itself may be of the natural size, or it may be increased or diminished. Ulceration of the mucous membrane is infrequent, and when it does occur it rarely leads to perforation. When the effusion of lymph is very great, it may produce partial obliteration of the excretory passages, and so embarrass the flow of urine.

III. The *renal parenchyma* itself is comparatively seldom diseased, which is surprising when we consider the great activity of its functions, and the facility with which its secretions are modified by the most trifling deviations from health. The principal affections of this gland may be referred to inflammation, suppuration, softening, induration, scirrhus, encephaloid, tubercles, serous cysts, hydatids, hypertrophy, atrophy, and earthy concretions.

Acute inflammation of the renal tissues is a very rare disease; it may affect the entire gland, or occur in circumscribed patches, and is more frequent in the cortical than in the tubular substance. The redness which accompanies it is generally limited, and varies from the slightest increase of the natural tints to a deep chocolate. This change is ordinarily combined with softening, slight intumescence, and sero-purulent infiltration. The discoloration is at first very trifling, and readily disappears under pressure and ablution. Subsequently it becomes deeper and more permanent. The injection on which the alteration of the color depends differs as it occurs in the tubular or cortical substance. In the former, it is striated; in the latter, capilliform, and disposed in beautiful wreaths. In both, it is frequently attended with small, red, black, or brownish points, not larger than a pin-head, and scattered in great numbers over the surface of the gland, interspersed through its parenchymatous tissues. These little dots, which are merely so many ecchymoses, are sometimes surrounded by minute vesicles, which are distinct from the orifices of the divided vessels, and are nothing else than the corpuscles of Malpighi, encircled by a delicate vascular zone. In the cortical substance these little bodies are usually arranged in lines, groups, or little patches.

In the more advanced stages of the disease, the affected part is of a deep red or purple color, the ecchymoses are larger and more numerous, the vessels are filled with black blood, the renal tissues are remarkably softened, and the section of the organ exhibits numerous purulent depôts, hardly as large as a pin-head. These depôts, which are most abundant in the cortical substance, often elude detection. In a small proportion of cases, globules of lymph are effused, of a pale straw color, not unlike the Malpighian corpuscles of the spleen.

*Nephritis* — for so this disease is termed — is commonly attended with great constitutional excitement, irritability of the stomach, and a discharge of bloody urine, or urine mixed with pus. The pain may be very slight, or so obtuse as almost to escape notice. In the majority of cases, however, it is extremely severe, and is not only felt in the region of the kidney, but darts along the ureter into the pelvis, and up towards the chest and spine. With these symptoms there is more or less numbness of the thighs, the testicle is retracted and tender on pressure, and there is a frequent desire to void the urine, which, when the disease is severe, is either limpid and scanty, very high-colored and bloody, or entirely absent. When this happens, we observe the same phenomena as in animals from which both kidneys are removed; that is to say, the constitutional excitement becomes extremely violent, the skin exhales a strong urinous odor, deep coma sets in, and the patient expires in great misery.

Nephritis may terminate by resolution, or it may relieve itself by softening, by passing into the chronic state, or by the formation of purulent matter. In the latter case, the pus, on inspection, will be found infiltrated into the glandular substance, or collected into an abscess. When infiltrated, the fluid oozes out muddy and blood-tinged on pressure; and, when there is much softening it sometimes gives the organ a dark pultaceous appearance, like the lees of wine.

When *abscesses* occur, they may be seated on the outer surface of the organ, beneath the fibrous envelope, in the parenchymatous texture, or in the pelvis and calyces. They may be numerous and very small, or few and large; in other words, they may vary in size from that of a millet-seed or a pea to that of a walnut, a fist, or a fetal head. When numerous or voluminous they may completely destroy the glandular structure, and convert the organ into an immense purulent cyst. Of this description was the case of a gentleman, forty years of age, whose body I examined in Philadelphia, in 1828. He had long suffered under symptoms of chronic nephritis; and, on inspection, the left kidney was found reduced to a mere membranous shell, containing three pints of a thin chocolate-looking fluid. All the other viscera were healthy, excepting the stomach, which exhibited marks of former inflammation. Very often the sac is thick, laminated, and multilocular; the intersecting bands, of a hard, fibro-cartilaginous consistence, grating under the knife.

The matter contained in these abscesses varies not a little in its physical properties. It may be homogeneous, that is, it may be a uniform, opaque fluid, like healthy pus; or it may be heterogeneous, or intermixed with foreign ingredients. In the first case, the matter is opaque, of nearly uniform consistence, inodorous and of a yellowish-cream color, with small masses of coagulating lymph. In the second case, it is thin and serous, or sero-purulent, lactescent, whitish, or greenish-white, and partly thick, viscid, and curdy, similar to that of a serofulous abscess. The fluid is also sometimes slightly reddish, or tinged with blood, and not unfrequently it contains sabulous matter, or even tolerably large concretions. It may be entirely inodorous; but occasionally it is quite fetid.



Renal abscesses generally open into the pelvis and ureter, their contents being thence discharged along with the urine. More rarely the matter finds its way to the external surface, into the cellulo-adipous tissue of the loins, or into the intestinal canal. It may also be evacuated into the peritonæal cavity, and in a few rare instances it has burst into the bronchial tubes, from which it was afterwards discharged by coughing.

*a.* The most favorable direction in which the abscess can break is into the pelvis of the kidney, from which the matter may afterwards pass along the natural channels. When the accumulation is considerable, a large quantity of fluid may thus be evacuated at once, or it may come away slowly and almost imperceptibly. The urine, in the former case, will be of a whitish, lactescent appearance, ropy, unnaturally thick, and more or less fetid; in the latter, it will be little, if at all, changed in its character, and deposit merely a slight sediment on cooling.

*b.* The matter may escape externally by exciting ulcerative absorption of the cellular tissue, muscles, and aponeuroses of the dorso-lumbar region. The progress of the fluid is indicated by excessive pain in the part, and by a hard, prominent tumor, which, becoming red, soft, and fluctuating, finally gives way at one or more points. The opening thus produced frequently assumes a fistulous character, and may continue to discharge pus, or pus, urine and sabulous matter, for many months and even years. The kidney, in this case, gradually wastes, and is ultimately reduced to a membranous bag, containing merely a little thin purulent fluid. If the matter cease to flow, a spontaneous cure may follow.

*c.* The ulceration may take place through the ureter, pelvis, calyces, or renal parenchyma, and the contents of the abscess escape into the cellular tissue of the loin. The event is preceded by violent inflammation, generally terminating in extensive infiltration and mortification of the soft parts. The muscular fibres are more or less disorganized, the cellular tissue is converted into a dark slough resembling wet tow, and the effused matter, which occasionally extends down to the groin and amounts to many ounces, is almost insupportably offensive. Howship and Chomel each mention a case where the peritonæum was perforated, and some of the purulent fluid extravasated into the general cavity of the abdomen.

*d.* In the fourth place, the matter may be evacuated into the alimentary tube. The portion of intestine involved may be the ascending or descending colon, the transverse arch, or the sigmoid flexure. In 1842, in inspecting the body of a boy four years and a half old, whom I had cut for stone eighteen months previously, I found a ragged, fistulous opening, about the size of half a dime, leading from the pelvis of the left kidney to the descending portion of the colon. He had labored under nephritic symptoms for several months, and had latterly voided purulent matter both along the bowel and the urethra. It is not often that the small intestine or the cæcum is the seat of the ulcerative perforation. In a case mentioned by Rayer\* a communication existed between the right kidney and the duodenum.

*e.* The abscess may burst into the peritonæal cavity; but this occurrence is so rare that some have even doubted the possibility of it. Mr. Howship,† however, has recorded an instance in a boy seven years old, who had been affected with disease of the urinary apparatus from the age of eighteen months. Numerous abscesses existed in both kidneys, the largest of which, seated in the left organ, had discharged its contents into the abdominal cavity, where

\* *Traité des Maladies des Reins*, Pl. xx.

† On the Urinary Organs, p. 39.

it produced violent peritonæal inflammation, under which the patient rapidly sunk.

*f.* Another mode in which the purulent matter may open a path for itself is through the diaphragm and pulmonary tissue. Of this occurrence only three well-authenticated examples have been published; the first by Meckel,\* the second by De Haen,† and the last by Rayer.‡ They all existed on the left side, and all terminated fatally, and the kidney in all was dilated into a membranous sac without any trace of the original gland. The patients lived some time after the fistulous communication was established, and expectorated fetid, sanious, purulent matter.

It has been supposed that the matter might find an outlet through the spleen, liver or bile-ducts; but of such an occurrence, supposing it to be possible, I have not met with an example, either in my reading, or in my dissections.

Finally, the matter, instead of finding a vent by some of the routes above specified, may be retained in the pelvis and calyces, in consequence of the obstruction of the ureter, produced by adhesive inflammation, the presence of a renal calculus, or the deposition of tubercular matter. When this happens, the parenchymatous texture of the kidney is gradually destroyed, and the organ is dilated into a thick, tough, membranous pouch, capable of holding many ounces or even several quarts of purulent fluid. Of this form of abscess many examples have been published by pathologists. In the eighteenth volume of the Edinburgh Medical and Surgical Journal is recorded the case of a medical practitioner, whose left kidney was found dilated so much as to contain nearly a pound and a half of sero-purulent fluid, which had been the product of several attacks of renal inflammation, occasioned by the presence, in the upper end of the ureter, of a small mulberry calculus weighing only one grain and a half.

Abscess of the kidney seems in some instances to be connected with disease of the spinal marrow, and the nerves which are detached from it. Four highly interesting cases of this kind have been recently published by Mr. Stanley, in the eighteenth volume of the London Medico-Chirurgical Transactions. Most of the patients had been affected with paralysis of the lower half of the body, with tenderness of the spine, pain in the loins, and irritability of the bladder. The kidneys, in nearly all, were gorged with blood, of a dark color, remarkably flaccid, and infiltrated with purulent matter. From the apparent absence of disease of the spinal marrow in several of the cases recorded by Mr. Stanley, he seems disposed to conclude, very erroneously, as I think, that the paralytic symptoms were caused by the renal lesion. The relations between these affections are certainly interesting, and will, I doubt not, receive the serious attention of pathologists.

Although inflammation sometimes terminates in *softening*, yet this is unquestionably a very rare occurrence. Of this affection there are two varieties. In one, the substance of the kidney is of a pale greyish tint, with small dot-like points, and the patient lives a long while without being sensible of any disease of the urinary apparatus; in the other, which is generally attended with serious derangement of the health, and which occasionally proceeds to a fatal termination, the renal tissues are converted into a soft, spongy mass, resembling, when shook in water, the shaggy vessels of the placenta. The color in this species of softening may be red, grey, brown, or even purple. The symptoms in both

\* Voigtel, Handbuch der Path. Anatomie, vol. iii., p. 188.

† Ratio Medendi, t. x., p. 103.

‡ Traité des Maladies des Reins, Pl. li.

varieties are obscure, and consequently uncharacteristic. Like acute nephritis, of which this disease is commonly the result, it seldom implicates the entire viscus.

The kidney is seldom affected with *gangrene*; indeed, I am not certain that it is susceptible of this lesion. At all events, very little is known respecting it. Portal asserts that it is frequently observed as a consequence of inflammation, and that it is always preceded by severe pains in the lumbar region, acute fever, vomiting, and retraction of the testicles, with scanty secretion of urine, or even entire suppression of this fluid. In persons who die of this disease, the kidney is generally tumid, softened, and pervaded by a foul, offensive serosity. Some parts occasionally lose their consistence to a much greater extent than others, being of a black, livid color, and converted into a shreddy, putrilaginous substance.

In *chronic* nephritis, the redness is of a duller hue, and the affected parts frequently exhibit a marbled aspect. The structure of the kidney becomes hard and granulated, and the patient is gradually worn out by slow, hectic fever. Diabetes is a frequent attendant on this disease. In a few cases, I have seen the kidney converted into a yellowish homogeneous mass, without being able to discern the least trace of the original textures. Its size is also sometimes very much diminished, as I have repeatedly had occasion to remark in my dissections.

The *granular degeneration* of the kidney, originally pointed out by Dr. Bright, of London, is commonly the result of chronic inflammation, though occasionally it assumes an acute character. It consists essentially in a deposition of fibrinous matter, first in the glands of Malpighi, and at a later period in the cortical substance generally. The contraction of this matter leads to atrophy of the connecting cellular tissue and obliteration of the vessels, followed, in many cases, by great deformity and diminution of volume of the whole organ. The altered condition of the vascular system is rendered evident by the color of the part, by the microscope, and by the results of injection, which, in the confirmed stages of the disease, is no longer practicable. The affection is strictly analogous to cirrhosis of the liver, with which it often coexists, and may involve the whole kidney or only a part of it. It is not peculiar to any period of life, but is much more frequent in adults and old subjects than in children and infants. What influence, if any, sex exerts is not known. The blood generally contains urea, dropsical effusions exist in various parts of the body, especially in the cellular substance and peritonæal cavity, and the urine is loaded with albuminous matter.

Opportunities very rarely present themselves for examining the kidney in the incipient stage of this malady, because few patients die during such attacks. At a more advanced period the anatomical characters are so exceedingly variable that hardly any two writers are agreed respecting them. Thus they have been divided by authors into several forms, by Dr. Bright into three, by Solon into five, by Rayer into six, and by Rokitansky into not fewer than eight. The effect of all this is, not to promote, but to embarrass the progress of pathological inquiry. What these writers have described as varieties are unquestionably merely so many stages of the same morbid affection, which do not require separate consideration.

The kidney in the earlier stages of the disease is of a deep red, brownish, or modena color, engorged with blood, and unnaturally soft. The loss of cohesion, however, is inconsiderable. The outer surface of the organ is somewhat rough, and the vessels which are distributed over it are arranged in small tufts or clusters. The fibrous tunic is easily stripped off, and does not exhibit



any change of structure. When divided longitudinally, the section is found to be of a brownish color in the cortical substance, and of a deep red, chocolate, or amber-brown in the tubular. The whole gland is hypertrophied, flabby, and very vascular. At a later period, but before the degeneration has made much progress, the outer surface, though less deep in color, is still more irregular, from the presence of numerous elevations and depressions, the latter of which are remarkable for containing little clusters of red vessels. By the aid of the microscope, and sometimes with the naked eye, numerous solid corpuscles may be detected upon it, like grains of sand; they are extremely minute, of a rounded or globular shape, and of a pale greyish color. The cortical substance, in the interior, is of a lighter complexion than in the sound state, and generally exhibits some shade of drab, fawn, or yellow. Innumerable little bodies, similar to those on the surface, are every where visible, and impart to the section the characteristic granular appearance from which the disease derives its name. The tubular cones retain their natural color, but are sensibly diminished in size, flattened, and even notched. The organ may be of the natural volume, but in general it is hypertrophied, and one-fifth, a fourth, or a third larger than in the normal condition. In a small proportion of cases it is reduced in size.

In the more confirmed stages of the degeneration, the fibrous envelope is so firmly attached to the cortical substance that a portion of the latter comes off with it; it is tough, opaque, and unnaturally thick. In very young subjects it not unfrequently presents white milky-looking spots, of various size and shape. The surface of the kidney has a peculiar marbled or mottled appearance, and some parts of it are occasionally of a slate-grey or leaden-grey color; numerous vessels are seen upon it, and the whole, or the greater portion of it, is moulded into large hollows and elevations, so as to seem tuberculated or mammillated, like the surface of a cirrhotic liver. The cortical substance is very much indurated, and presents little or none of its striated character; its vessels are nearly all obliterated, and consequently incapable of receiving injection; its color is extremely variable, but the most common shades are buff, yellowish-grey, Sienna-yellow, or pale straw. The granulations which exist in great profusion are closely aggregated together, globular, or irregularly rounded in their shape, of a pale yellowish or greyish color, and from the volume of a small pin-head to that of a millet-seed, or a grain of sago. When divided, they are found to be solid, firm, incompressible, and apparently homogeneous. The tubular cones are either very much atrophied, or entirely effaced by the pressure of the cortical prolongations. The kidney itself is generally more or less deformed, considerably diminished in volume, and remarkably firm, sometimes almost cartilaginous.

Fig. 179.



The renal artery in this advanced stage is almost always very small, and some of its main branches are entirely obliterated, either by fibrinous concretions, or by the adhesion of their sides. Andral states that, in one instance, he saw the granulations in the tubular structure; but this was probably a mistake. According to the theory advanced above, they should always be confined to the vascular substance; and this, there is reason to believe, is uniformly the case. The different appearances of the granulations, as occurring on the surface and in the interior of the kidney, are exhibited in the annexed wood-cuts. (Figs. 179, 180, 181.)

Fig. 180.

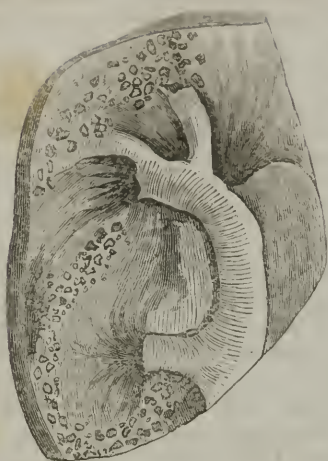
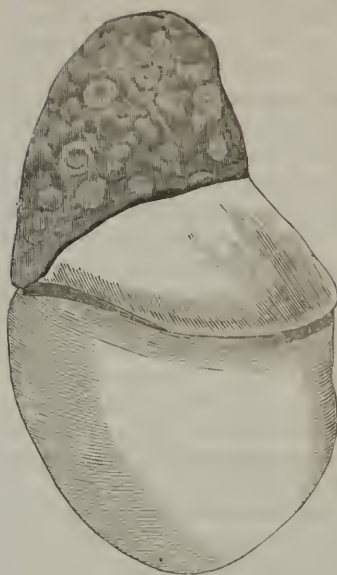


Fig. 181.



*Induration* of the kidney, like *mollescence*, may be divided into two species, one of them being attended with increased vascularity, the other with remarkable pallor. In the former, the organ is generally enlarged; in the latter, diminished. In the pale induration, the kidney occasionally retains its natural structure, excepting that it is unusually firm; sometimes, indeed, as will be shown hereafter, it may even be of a fibro-cartilaginous consistence. When both organs are thus affected, very little urine will be secreted, and the patient will complain of the various symptoms which characterize chronic disease of the other viscera.

*Scirrhus* of the kidney is a very rare disease; I have met with it only once in the human subject, though I have several times seen it in the hog. The organ, in the case to which I refer, was at least six times the usual bulk. It adhered to the liver, colon, and wall of the abdomen, and formed a big tumor which could be prominently felt in the right lumbar region, between the lower rib and the crest of the iliac bone. In the interior of the kidney were eight large scirrhous masses, some of which were of a white bluish tint, hard, gristly, and intersected with yellowish-looking filaments; others were broken down, and converted into a thin chocolate-colored fluid. All traces of parenchymatous structure were lost, except towards the upper extremity of the viscus, where is still retained some of its normal features. Both the pelvis and ureter were closed up by the heterologous substance. The opposite kidney was of the usual size, but extremely pale, and the cortical and tubular textures were so blended that it was impossible to distinguish them from each other.

This disease occurred in a child, two years and a half old, whom I saw in consultation with the late Dr. Marshall, of Cincinnati, in 1836. The body was excessively emaciated, the abdomen hard and distended, and the right lumbar region unusually prominent. All the intestines were firmly agglutinated together, and the mesenteric ganglions, of a white rose color, and gristly hardness, presented one agglomerated mass of disease. Individually

they varied in size between a cherry and an orange. The entire mass nearly equalled a cocoa-nut, and embraced loops of intestine, the aorta, vena cava, and choledoch duct. The thoracic viscera, the stomach, small bowel, spleen, and urinary bladder, were perfectly healthy; the anterior margin of the liver had a few tumors similar to those of the kidney; and the mucous membrane of the colon exhibited patches of inflammation, with here and there a small ulcer.

There are no symptoms, which, so far as we know at present, can be considered as diagnostic of this disease. In the case just detailed, the little patient frequently suffered under severe pain in the region of the right kidney, but at no time was there, I believe, any particular disturbance of the urinary function. The disease is most common in persons after the middle period of life.

Much more common than scirrhus is *encephaloid*, a disease which may make its appearance at any period of life, though it is by far most frequent in young children. The heterologous matter may be deposited into the renal vein or the excretory tube; and in some instances the whole organ is transformed into a soft pulpy mass, of the color and consistence of the brain. Andral alludes to a case of *encephaloid*, where one of the kidneys had attained the dimensions of the right lobe of the liver; and Mr. Langstaff, of London, has described another, in which the diseased mass weighed nearly twelve pounds. Externally, the tumor was irregularly lobulated, and on cutting through it, a large clot of blood was found, composed of loose, concentric layers, as in a rapidly formed aneurism.

When this disease is present in the kidney it usually exists also in some other part of the body. In general it is attended with severe suffering, though the symptoms are often vague and unsatisfactory. In the majority of cases there is pain in the region of the affected kidney, difficulty of voiding the urine, which is often tinged with blood, and great irritability of the bladder, the uneasiness extending along the rectum and urethra, and in the female along the uterus. In the lumbar region, there is gradual enlargement, with more or less pain on pressure, and inability of lying on the affected side.

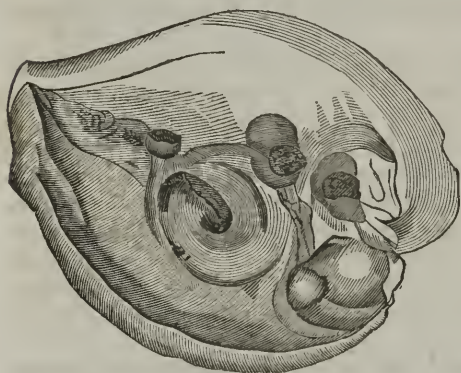
In the sixteenth volume of the American Journal of the Medical Sciences is related a case of *encephaloid* disease of the kidney, in a female thirty-five years old, which, as has been justly observed by the reporter, Dr. Weems, of Washington city, was remarkable for the total absence of every symptom, direct or indirect, that could have caused a suspicion of the existence of renal disorder. The left kidney, increased to the weight of seven pounds, was completely disorganized, and converted into a soft, bloody, cerebral mass, in which it was impossible to discern any thing of the normal structure. The disease had existed for about four years, and been treated for an enlarged spleen. An instance of a somewhat similar character is mentioned in the London Medical Gazette for May, 1831: it occurred in a child only four years old: the symptoms of renal affection here were so trifling that the medical attendant never suspected that it was the cause of the patient's distress. Thus, then, whilst *encephaloid* of the kidney is sometimes accompanied with sufferings the most excruciating, at others its features are so masked as to render it utterly impossible to distinguish its true character.

It is not often that *tubercles* occur in the kidney, and then only in connection with the same disease in other situations, particularly the lungs, lymphatic ganglions, liver, intestines, and genito-urinary apparatus. The heterologous matter may be deposited on the surface of the organ, in the cortical substance, or in the uriniferous cones, in the form of small disseminated masses, from the



volume of a mustard-seed to that of a cherry or small marble, of a pale yellowish or whitish aspect, and of a firm, cheesy, almost fibro-cartilaginous consistence. Their number is sometimes immense. Thus, in the right kidney of a young man, of twenty-seven, who died of psoas abscess, in the Cincinnati Hospital, there were upwards of five hundred in the cortical substance, of all sizes between that of a mustard-seed and a cherry-stone. In some parts they were agglomerated, in others isolated. They were of a white opaque appearance, semi-cartilaginous in their consistence, and evidently organized, since, in cutting through some of them, I could distinctly trace the existence

Fig. 182.



of vessels, the blood standing upon the incised surface in minute dots. Externally the organ had a dark mottled aspect, and in its interior were two tubercular excavations; one, situated in the superior extremity of the gland, was scarcely larger than a hazelnut; the other, which occupied the lower half of the viscus, was about the size of a turkey's egg, and filled with thin, ropy, whitish pus, destitute of smell. The abscess was lined throughout by a thick layer of lymph, and intersecting it in different directions were four rounded cords, the

remains, probably, of the tubular texture, which resembled a good deal the fleshy columns of the heart, or the bands which we so often see in tubercular excavations of the lungs. (Fig. 182.) The kidney was very little enlarged, and some tubercular matter was also found in the excretory passages, the cavity of the ureter having been nearly obliterated by it.

In this case not a tubercle could be detected in the lungs. They were, indeed, perfectly sound, as were also the heart and brain, together with most of the abdominal viscera. Strumous matter was abundantly contained in the lymphatic ganglions of the pelvis, and the seminal vesicles were completely distended with it.

The tubercular matter is sometimes deposited upon the free surface of the calyces, pelvis, and ureter, either in small, circumscribed, granular masses, or in that of a continuous layer, of variable thickness, yellowish or greyish in its color, and more or less accurately moulded to the shape of the containing parts. The quantity of the effused matter may be very small, or so large as to lead to serious impediment to the passage of the urinary fluid. I have twice found it so great as to cause complete obliteration of the commencement of the ureter.

The volume of the kidney may be natural or diminished, but most commonly it is somewhat increased. It has been said that both organs are usually attacked by this disease; an opinion which is disproved by the observations of Rayer, who found double tuberculization only in six cases out of sixteen. Of the remaining cases seven occurred on the left side.

*Melanosis* of this organ has been found only in a few instances. Like tubercle, it rarely, if ever, exists except in association with similar deposits in other parts of the body, as the skin, cellular tissue, lungs, liver, and serous membranes. It may present itself as an infiltration, but more commonly it occurs in small disseminated tumors, from the size of a pin-head to that of a hazelnut, of an irregularly spherical figure, hard, of a black, brownish, or dark-

greyish color, and embedded in the cortical substance, immediately beneath the fibrous capsule. It appears probable that the heterologous matter may occasionally be deposited in a distinct cyst. Trousseau and Leblanc,\* in their memoir on melanosis, refer to a case in which a bag of this kind contained eight ounces of liquid of the color and consistence of ink. When the new substance is very abundant, the kidney is usually somewhat augmented in volume, but in almost all the cases hitherto observed it retained its normal bulk and form.

I have never met with what is called the *erectile tissue* of the kidney, but such an affection has been described and delineated by Rayer. It is of a spongy, vascular character, analogous to the cavernous body of the penis, and is formed by the interlacement of a great number of small veins, dilated at various points of their extent, and supported by delicate cellular substance. In the two cases observed by the French pathologist, and which, I believe, are the only ones on record, the little tumor was seated in the cortical texture of the kidney, and coexisted with a similar alteration in the liver, unaccompanied by encephaloid or scirrhus.

*Serous cysts* in the human kidney are probably of less frequent occurrence than is supposed by pathologists. They are very common, however, in the hog, and it is here that the best opportunity is afforded for examining them in the different stages of their development. In reference to their origin, these cysts may be arranged under three heads. Under the first are comprised the little vesicles which are developed upon the exterior of the kidney, immediately beneath the fibrous covering. At an early period they are exceedingly small, hardly as large as a mustard-seed; but as they increase in size they may acquire the volume of a cherry, a hazelnut, a plum, or, in very rare cases, even of a child's head. Their number varies from one or two to several dozens, fifty, a hundred, or even two hundred. I have repeatedly seen them scattered over the surface of the organ, so as to give it the appearance of being inlaid with them. They are of a spherical shape, and filled with a thin, pellucid fluid, which possesses all the properties of the serum of the blood. Fig. 183, from a preparation in my cabinet, is a beautiful representation of this variety of the disease.

The cyst in this form of the disease consists of a single lamella, smooth and

Fig. 183.

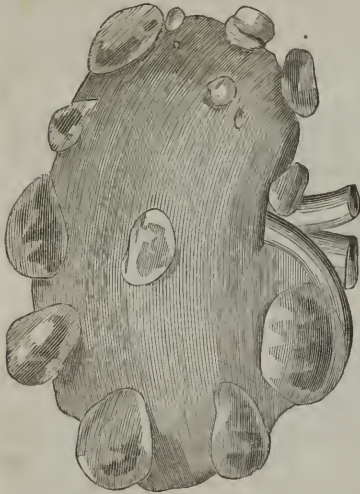


\* Arch. General. de Méd., Juin, 1828.

polished internally, and closely adherent by its outer surface to the cortical substance in which it is embedded, as well as to the fibrous capsule which is spread over it. This lamella is probably of new formation, and, like similar structures in other situations, it is liable to become opaque, thickened, and indurated by inflammation. The fluid in this event also experiences certain changes; it loses its transparency, augments in consistence, and assumes a turbid, milky, reddish, or greenish aspect. It is seldom that this cyst is multilocular.

The second class consists of cysts which are developed deep within the cortical structure, or, more properly speaking, in the granulations of Malpighi. (Fig. 184.) These little bodies are supposed to be hollow; at

Fig. 184.



least such was the opinion of their discoverer, which has since been adopted by many highly respectable anatomists. Now, when, from any cause, these bodies are irritated, their cavities become distended with serous fluid, which continues to accumulate until a distinct vesicle is formed, varying in size from a pea to that of a walnut, and the walls of which consist, for the most part, of a thin fibrous lamella. The pressure exerted by the effused fluid, gradually produces the absorption of the renal parenchyma, until at length the cyst approaches the surface of the kidney, where it generally presents itself as a globular body, and receives an additional covering from the investing membrane of the organ. The contained fluid is not always of a serous character, but frequently possesses all the properties of urine, only that it is more limpid, and less strongly impregnated with saline matter.

In the third class are included the serous bags which are formed in the uriniferous tubes, the calyces or pelvis of the kidney, in consequence of some obstruction to the free escape of the urine into the bladder. This is a very common variety, and the tumor is sometimes of considerable size. The manner in which it is formed is easily understood. Let it be supposed that one of the calyces becomes closed by adhesive inflammation, and that the renal substance remains perfectly sound. The cortical structure will of course continue to perform its function, and the urine that is secreted will be readily conveyed by the uriniferous tubes into the proper excretory duct. Here, however, its further progress will be resisted by the obstruction in question, and hence, as the accumulation increases, it will necessarily encroach upon the corresponding pyramid, and finally upon the cortical texture, destroying them by absorption. In this manner the renal parenchyma is sometimes completely removed, and the organ reduced to a mere shell, of a dense, fibrous consistence, rough, and hilly externally, and intersected or not by membranous bands. If, at this stage of the disease, the tumor be carefully examined, it will be found to be highly vascular, and to be composed of three distinct layers, the internal of which corresponds with the mucous lining of the excretory canal, the second with the submucous cellular tissue, and the third with the fibrous capsule, the whole being intimately united by organized lymph. (Fig. 185.)

The contents of these cysts, at first urinous and subsequently of a serous character, may be clear, lactescent, reddish, greenish, yellowish, or coffee-colored, and



of a thin watery consistence, or thick, ropy, flocculent, and albuminous. In many instances they are purulent, sero-purulent, or sanguinolent. Occasionally, though rarely, they consist almost wholly of pure blood, partly fluid, and partly coagulated. A case is mentioned by Mr. Martineau,\* in which such a tumor was tapped during life, and ten pints of blood let out. The kidney was transformed into an immense pouch, without any trace of its original texture, and the canal of the ureter was completely obliterated. A similar example is narrated by Cowper, in the nineteenth volume of the Philosophical Transactions of London.

A beautiful preparation, which represents the right kidney, and contained upwards of two gallons of pure pus, is in the private collection of the distinguished professor of anatomy of the Institute, to whom it was given by my friend Dr. W. C. Sneed, of Frankfort. It was removed from the body of a man twenty-six years of age, an inmate of the Kentucky Penitentiary. The sac was exceedingly vascular, and about the thickness of the human skin; it was formed mainly at the expense of the ureter, which was entirely closed, and was studded internally by a number of bony deposits, some of which were very firm and as large as a thumb-nail. The renal tissue was completely absorbed, and in place of the papillæ were seven digital pouches, isolated, and large enough to admit a finger.

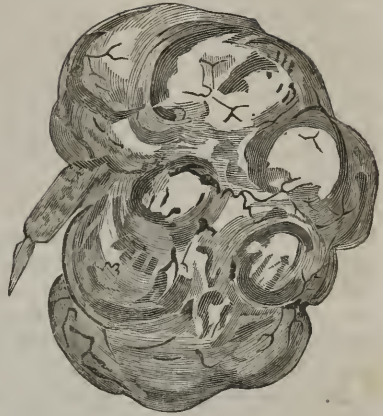
The quantity of water varies from a few drachms to many ounces or even pounds, according to the dimensions of the cystiform enlargement. Occasionally it is immense. Thus Lieutaud† records a case in which there were thirty-five pounds of water; and in another mentioned by Glass,‡ it amounted to nearly thirty gallons. In this instance the fluid was of a light coffee color, and the bag in which it was contained filled nearly the whole abdomen. It was scabrous on its inner surface as if parboiled, and in its general appearance it strongly resembled the uterus of a cow, at the end of gestation.

This variety of cyst, it may now be observed, constitutes what has been called renal dropsy, and what Rayer has recently described under the name of *hydronephrosis*. The disease is usually of slow formation, and may go on for years without seriously impairing the general health. It may exist in both kidneys at the same time, and be complicated with other affections, particularly of the bladder and urethra.

The three species of serous cysts now described I have had frequent opportunities of studying, both in man and in the lower animals. The views I have advanced will be found not to differ materially from those of Bouillaud, Cruveilhier, and other anatomists, on the same subjects.

*Hydatids* may be developed, first, on the external surface of the kidney, beneath its proper capsule; secondly, in its parenchymatous substance; and, thirdly, in its excretory passages. In their size they vary between a hemp-

Fig. 185.



\* Edinb. Medical Comment., vol. ix.; Howship on the Urinary Organs, p. 31.

† Hist. Anat. Med., ob. 1065.

‡ Philos. Trans. of London, vol. xlv.

seed and an orange; in number, from one to several hundred. The older hydatids usually contain clusters of young ones, which either float about in the serous fluid, or are attached to their inner surface. The outer cyst often possesses the firmness of a fibrous membrane; it may also be incrustated with chalky matter, or partially transformed into bone. These changes are more frequent in the sheep and other animals than in the human subject. When very large or numerous, which, however, is not often the case, the hydatids may destroy the parenchymatous substance of the kidney, and so give rise to the same morbid states as the serous cysts already described. They may remain pent up in the situation where they are originally developed, or they may escape into the excretory canals, and be evacuated along with the urine. In a case narrated by Weitenkapf, the patient voided on some occasions as many as fifty or sixty hydatids at a time; they were of the cystocercic species, and some of them were alive when discharged. In a few rare instances these bodies have made their way through the lumbar region by inducing ulcerative absorption.

In a few instances I have seen the kidney transformed into a substance resembling *fibro-cartilage*. In one of the cases to which I refer, the organ was less than one-third the natural volume, remarkably white, dense, fibrous, and creaked sensibly under the scalpel on being cut. The fibrous capsule was inseparably adherent to the outer surface of the kidney, the ureter and funnel-shaped processes were obliterated, and scarcely a trace remained of the tubular structure. The renal vessels, both artery and vein, were much diminished in size, and many of their larger branches, with nearly all the smaller ones, had disappeared. This transformation sometimes occurs in small patches, which are generally of a light bluish tint, and distinctly fibrous in their texture.

The kidney has been found partially *ossified*. The earthy matter is mostly confined to the uriniferous tubes, where I have seen it form narrow, slender pencils, running the whole length of the pyramids. The number of these lines, which are commonly of a pale yellow color, is sometimes very considerable, hundreds of them occurring in a single specimen, perhaps in a single cone. In several cases in which I carefully examined this lesion, it appeared to me that the earthy substance was deposited into the walls of the uriniferous tubes. Occasionally it is not improbable that the appearance is caused by small arterial branches, in a state of ossification.

Laennec, Dupuytren, Petrequin, Bicheteau, Cruveilhier, Rayer, and other pathologists have described what is called the *fatty degeneration* of the kidney. Such an appearance I have repeatedly met with in the hog, but only a few times in the human subject. It is analogous to the adipous transformation of the liver, and is rarely attended with any serious symptoms. In many cases, indeed, it would seem to be compatible with the most perfect health. When this state is present, the kidney is of a pale, yellowish complexion, has a soft, fatty feel, and readily greases the scalpel. Pascal has described an instance in which the organ yielded a multitude of drops of oil under pressure. Such an occurrence, however, must be very rare. The fibrous capsule can always be peeled off much more easily than in health, and in most of the cases that have fallen under my observation, the transformation was confined to the cortical substance, the pale tint of which strikingly contrasted with the fleshy red of the uriniferous cones. In an advanced stage, the two structures are so much alike in color that it is no longer possible to distinguish them from each other. The fatty kidney rapidly putrefies, and yields a peculiar oily principle by boiling.

There are, properly speaking, two varieties of form in which the fatty matter

in this disease is deposited. In the one just described, it exists as an infiltration, which may be limited to a particular portion of the organ, or pervade its entire structure. In the other, which is very rare, the greasy matter, instead of being diffused through the renal parenchyma, is collected in little, rounded masses, either separated, or agglomerated, of a soft, jelly-like consistence, and of a pale, yellowish, or brownish color. Their number is generally small, and it is seldom that they involve the entire gland. The kidney, in both these varieties of form, may retain its natural shape and bulk; or it may be more or less disfigured, and diminished or increased in size. The cause of this degeneration is altogether unknown.

Large quantities of fat are sometimes collected round the kidney, which, from the pressure thereby sustained, experiences a certain degree of atrophy. Similar accumulations are occasionally found round the pelvis and calyces, followed by similar results.

Andral has seen the kidney converted into a semi-fluid, glass-like substance, resembling a thick solution of starch. Such a lesion has never come under my observation, and I presume that it is very rare. In the case mentioned by the French anatomist, the transformation was confined to the cortical substance, and the individual showed no symptoms of urinary disease during life.

*Hypertrophy* generally exists only in one kidney, the other being either reduced in volume, or else absent. It is recognized by the following characters: the kidney is one-fourth, one-third, or one-half larger than in the normal state; and its substance is of a deeper color, more firm and compact. A development of this kind, under whatever circumstances it may occur, may be supposed always to depend upon an increased determination of blood to the sound organ. Hence we frequently find that the enlarged kidney is furnished either with two arteries, or with a single one of unusual size. In other cases, chronic irritation gives rise to this preternatural bulk of the organ, by keeping up habitual congestion. This state of the kidney, combined with augmented vascularity, is a common appearance in diabetes.

Not unfrequently the state of the kidney is diametrically opposite to the one just described, its size being much less than natural, and its parenchymatous structure pale, indurated, and shrivelled. As hypertrophy is the result of an unnatural supply of blood, so atrophy of the kidney may be regarded as the consequence of a deficiency of this fluid. In some instances, this appearance is strictly congenital; but most commonly it is caused by an obstruction in the circulation of the blood, arising from the pressure of a tumor in its vicinity, an enlarged liver or spleen, or a collection of pus around its exterior. I have a specimen of atrophy of the kidney in which the parenchymatous texture was nearly entirely destroyed by a number of serous cysts that were developed in its interior.

The kidney, notwithstanding the firmness of its texture and the depth at which it is situated, is liable to *laceration* from external violence. Cases illustrative of the nature of this lesion have been published by Laub, Metzger, Pyl, Morgagni, Verduc, Donnellan, Hackmann, Laidlaw, B. B. Cooper, Rayer, Kirkbride, and others. The rupture may be confined to the cortical substance, or it may extend through this into the tubular, or even into the pelvis and calyces, though this is exceedingly rare. Occasionally it passes through the whole thickness of the organ, so as to divide it into two distinct parts, one of which is generally somewhat larger than the other. In its direction the fissure, crack, or rupture is usually transverse or oblique, seldom longitudinal. The number may be limited to one, or there may be as many as eight or nine, as in the interesting case narrated by Dr. Kirkbride,\* of Philadel-

\* American Journal of the Medical Sciences, vol. xv., p. 359.



phia, in which the principal rent was three inches and a half in length by nine lines in depth.

Rupture of the kidney is usually attended with considerable effusion of blood into the surrounding cellular tissue, and even into the peritonæal cavity. It may occur alone, or be complicated with laceration of the liver, spleen, bowels, or urinary bladder, with fracture of the ribs or pelvic bones, and with contusion of the skin and muscles. It is worthy of note, however, that, in some instances, there is no mark whatever of external violence, not even the slightest ecchymosis. The accident is commonly produced by falls from a height, or by the body being pressed between two hard and resisting objects. It may also result from the kick of a horse, and, in one instance, it was caused by a blow with a bludgeon upon the right lumbar region.\* The patient generally voids more or less blood soon after the injury; the period at which death occurs varies from a few minutes to several hours, days, or weeks. The lesion, however, is probably not always fatal. Rayet† says that he is fully convinced that where the laceration is superficial, or confined chiefly to the cortical substance, it is susceptible of cure, as much so as simple ecchymosis. Plastic lymph is effused between the lips of the rupture, by which the breach is ultimately repaired, and the extravasation of urine into the retro-peritonæal cellular tissue prevented.

The *concretions* which are so often found in the kidney, may be developed either in its parenchymatous substance, the calyces, funnel-shaped processes, or the pelvis of the ureter. In most cases, it would seem that they are the result of a peculiar diathesis of the system, and they generally consist of the same chemical elements as those of the bladder. The commonest variety is the uric calculus, which is usually of a light brownish color, and of a spherical shape, with a perfectly smooth surface. Next in point of frequency is the oxalic concretion, of a dark complexion, and of an irregular, oval figure, with a rough mulberry exterior. A third variety of renal calculus is the ammoniac-magnesian. This generally occurs in connection with one or the other of the preceding species, an external layer forming around them, varying in thickness from a line to half an inch or more. The phosphatic concretion is seldom met with in the kidney, and seems not to proceed from the urine, but from other secretions of the affected organ.

Renal calculi may exist for a long time unsuspected. Most generally, however, they produce hemorrhage, inflammation, abscess, or ulceration, with pain in the loins, obstruction to the flow of urine, uneasiness in the ureter and bladder, and constitutional disturbance. Should the concretion become immovably fixed in the excretory duct the urine, which is still secreted, will accumulate in the passages above; and, by the pressure which it exerts upon the parenchymatous structure, it will gradually effect its absorption, until the organ is wasted to a mere remnant. At other times, the ureter bursts, as the urethra sometimes does behind a stricture; or suppression of urine ensues, and the patient dies. Of these occurrences, interesting cases are recorded by Morgagni, Brodie, Travers, and other pathologists. The symptoms which denote the passage of a renal calculus are, violent pain in the lumbar region, excessive irritability of the bladder, discharge of bloody urine, numbness of the thighs, and retraction of the testicles, with sickness at the stomach and severe constitutional disturbance.

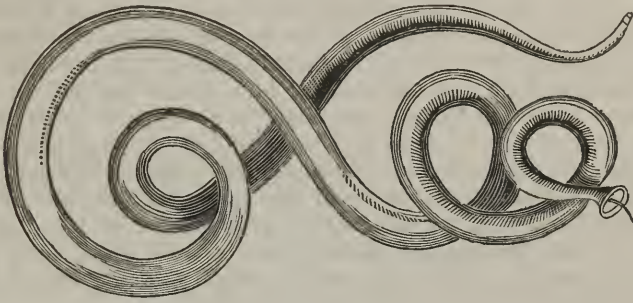
The *large strongyle* (Fig. 186), a species of lumbricoid worm, has been ob-

\* Morgagni, de Sedibus et caus. Morb., Epist. liv., § 15.

† Traité des Maladies des Reins, t. i., p. 271.

served in a few rare instances in the human kidney. It is oftener met with in the inferior animals, as the horse, ox, wolf, dog, otter, and racoon, and is exceedingly common in the hogs which are brought to the slaughter-houses in the environs of Cincinnati. The situations in which it is ordinarily found are the

Fig. 186.



pelvis and infundibular prolongations of the ureter, in which it is frequently coiled up in considerable numbers. Occasionally it makes its way into the parenchymatous structure, where it produces suppuration, atrophy, or other mischief. Mr. Owen supposes that the parasite is originally developed here, but this is probably a mistake.

The strongyle is a very slender cylindrical worm, from two to three inches long, of a light greyish color, interspersed with dark spots; in some instances it has been known to attain the length of three feet, with a diameter of from four to six lines. The male is smaller than the female, and tapers slightly towards each extremity. The head is obtuse, and furnished with an orbicular mouth, encircled by six hemispherical papillæ: the body is transversely striated, and marked by two longitudinal impressions; and the tail, which is incurvated, ends in a dilated pouch, from the base of which projects a single penis. In the female, the caudal extremity is less pointed than in the male, with the anus just below the apex; the vulva is situated at a short distance from the head, and communicates with a slender cylindrical vagina: the uterus, in the larger individuals, is about three inches long, and leads to a simple ovary, which is nearly four times the length of the body. A nervous system can be distinctly demonstrated in this parasite. It consists, according to the statement of Mr. Curling, of London,\* of two delicate rings, one encircling the œsophagus, the other the anus, connected by a single cord running in a straight line along the middle of the ventral aspect.

### SECTION III.

#### OF THE URETER.

The principal lesions of the ureter are, deposits of tubercular matter, effusion

\* See his Lectures on the Entozoa, in the London Medical Gazette, part v., vol. i., p. 712.

of lymph, thickening and attenuation of its walls, with contraction or enlargement of its cavity. Dilatation is generally produced by the retention of a renal calculus, or by some tumor seated along the course of the tube, and interfering with the egress of the urine. In the male, it is sometimes caused by stricture of the urethra; in the female, by the pressure of a carcinomatous uterus. In a case of this description, which fell under my notice several years ago, the left ureter was fully as large as the thumb, with remarkably thin, transparent walls. Sir B. Brodie mentions an instance where, in consequence of obstruction, both tubes were dilated to the size of the small intestine.

Small cysts, from the size of a pin-head to that of a pea, are sometimes developed beneath the mucous membrane of the ureter, either singly or in groups. They are of a spherical figure, transparent, and occupied by a thin watery fluid, by inspissated mucus, or by a yellowish, semi-concrete substance, not unlike that of tubercle. Occurring sometimes simultaneously in the calyces, pelvis, and ureter, they are most common in the latter situation, and are probably nothing but mucous follicles, enlarged in consequence of the obstruction of their orifices. As they augment in size some of these cysts burst, apparently from over distention, and discharge their contents into the ureter, leaving a small ulcer, with thin, irregular, and inverted edges.

Occasionally the duct presents a singularly sacculated arrangement, some portions of it being greatly expanded, others very much constricted. Sandifort\* mentions an instance where the dilatation, alternating with slight contractions, was more than two inches in circumference; and a still more extraordinary example has been recently recorded by Dr. Thurnam, of England. In both cases, there was congenital malformation of the urinary organs.

The ureters may be absent, and in some instances they have been known to terminate in a cul-de-sac. When the bladder is wanting, they open either into the urethra, the vagina, or the rectum. Occasionally, again, they are reduced to small, narrow, almost impervious cords; and when this happens, the pelves of the kidneys are generally dilated into large pouches, capable of holding many ounces of fluid. I have never seen valves in the interior of these tubes; but examples of this have been recorded by Coschwitz, Morgagni, Desgranges, and other writers, and are perhaps more frequent than is generally supposed. These folds, it may be remarked, are usually connected with a dilated and tortuous state of the ureters.

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## SECTION IV.

### OF THE URINARY BLADDER.

The urinary bladder, situated in the pelvic cavity, and composed of the same anatomical elements as the stomach, is seldom affected with disease. Acute inflammation, so common in the alimentary tube, is extremely rare in

\* *Observ. Anatomico-Patholog.*, t. iii.



the organ now under consideration, and in my own dissections I do not remember to have met with it more than twice. Such also is the result of the more extensive observations of Louis, Andral, and Hope. In five hundred individuals examined by the former of these distinguished pathologists, the mucous membrane of the bladder was found preternaturally red, and injected only in six cases, and ulcerated only in one. The disease usually occurs in small irregular patches, which present the arborescent, dot-like, or capilliform injection; but, in some instances, it affects the greater part of the organ, and is attended with effusion of lymph, or even extravasation of blood. Acute cystitis may terminate in suppuration, softening, and even in gangrene.

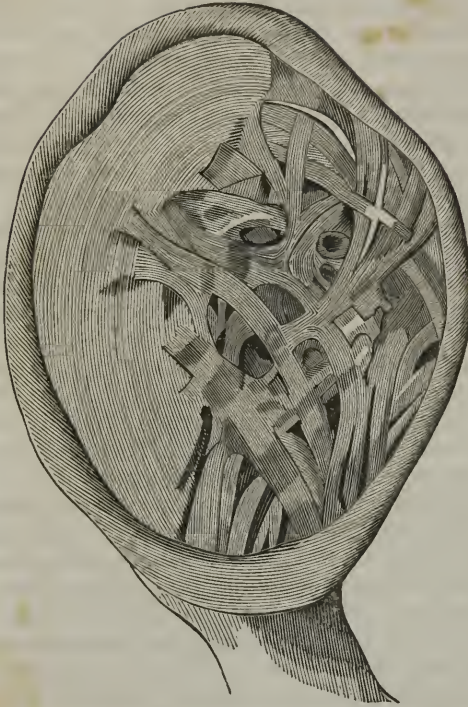
The termination by suppuration is by no means infrequent. The matter, in most cases, is poured upon the inner surface of the bladder, where, mixing with the urine, it imparts to this fluid a peculiar lactescent aspect, and sometimes a very offensive odor. In other cases, the pus collects in the submucous cellular tissue, or between the muscular and serous tunics, and finally escapes into the pelvic cavity. Occasionally the bladder contracts adhesions with the rectum of the male or the vagina of the female, and the matter finds an outlet in this way. The quantity of pus seldom exceeds two or three ounces.

It is very seldom, indeed, that the mucous membrane of the bladder is the seat of *softening*. When thus affected, it is of a dull white, pale grey, or drab color, devoid of vascularity, and so changed in its cohesive properties that it may be easily scraped away with the nail or the handle of a scalpel. It may retain its natural thickness, or it may exhibit a pulpy and infiltrated appearance, or it may be thin and withered. The softening may occur in patches of various shapes and sizes, or it may extend over the whole tunic, which, however, is extremely rare. In the few cases in which I have witnessed this lesion it was confined to the bas-fond of the organ, and was associated with other affections, as ulceration, tubercular deposits, hypertrophy of the prostate gland, or stricture of the urethra. In violent cystitis, the disease sometimes extends to the submucous cellular tissue and muscular fibres, which are infiltrated with serosity, changed in color, soft, and lacerable. There is a variety of mollescence of the urinary bladder which may be called *idiopathic*, as it is usually connected with a disordered state of the system, such as that arising from the excessive loss of blood, impoverished diet, or protracted indisposition. The mucous membrane, in this case, is of a pale, milky hue, either uniformly, or in small strips or patches, and of the consistence of soft glue, isinglass, or jelly.

*Gangrene* of the bladder I have never noticed, and I presume that this termination is extremely rare. The disease is most frequently seated at the neck of the viscus, and has hitherto been remarked chiefly as the result of the protracted retention of urine. The eschars are of a dark, livid color, soft, easily torn, and bathed with a thin sanious fluid, of an exceedingly fetid odor.

Chronic inflammation is much more frequent than acute, of which it is sometimes the result, and gives rise to various alterations, among which the more important are, hypertrophy, the formation of cysts, and fungous excrescences, not unlike those that have been described as occurring in the large bowel. Hypertrophy, although it may be seated in any of the tunics, is most common in the muscular, which sometimes acquires the thickness of an inch or more. The lesion is often partial, that is to say, it is limited to a small number of fleshy fibres, which are of a deep florid color, very strong, and collected into large bundles. When this happens, the inner surface of the organ becomes fasciculated, like the interior of the ventricles of the heart, and thus constitutes

Fig. 187.



what the French term the *columniform* bladder. (Fig. 187.) The accompanying wood-cut, which exhibits the various characters presented by this affection is taken from a specimen in my collection.

Hypertrophy of the muscular tunic, whether partial or general, is usually referrible to obstruction at the mouth of the urethra, to overcome which it is obliged to make increased exertion; a larger flow of blood is invited, and excess of nutrition, with diminished capacity of the reservoir, is the consequence. This condition frequently coexists with vesical calculi, enlargement of the prostate gland, and stricture of the urethra.

When the hypertrophy is seated in the lining membrane, or in the subjacent cellular substance, there is generally a great development of the mucous follicles, which, instead of being small and scarcely perceptible as they are in the normal state, are rendered

extremely prominent, and pour out an unusual amount of thick, ropy fluid. In

Fig. 188.



some instances we meet with well-developed villousities; and, more frequently still, with pretty large, fungous-looking excrescences. These vegetations, as they may be termed, are commonly of a light slate color, firm in their consistence, and of a pyriform shape, with a short, slender peduncle. Around their base are occasionally to be observed beautiful vascular wreaths, showing that they originate in inflammation.

The mucous membrane at the neck of the bladder is sometimes elevated into one or more horizontal ridges, varying from one to two inches in length by three or four lines in width. The annexed drawing,



(Fig. 188,) from a beautiful specimen in my cabinet, represents two prominences of this description, both of them of large size. The prostate gland is very much increased in size, and the muscular coat hypertrophied throughout. The lesion is evidently the result of chronic irritation.

A frequent consequence of hypertrophy of this viscus is the development of small *cysts*, caused by the outward protrusion of the mucous membrane, or by the interlacement of the muscular fibres. In the latter case, considerable cavities are sometimes intercepted, which become lined with a sheeting of lymph, and filled with different fluids, such as serum, urine, or pus. When the lining membrane is forced between the enlarged fasciculi, it occasionally dilates into a large pouch, perhaps half as large as the bladder itself, with which it communicates by a narrow aperture. This appearance is generally observed near the fundus of the organ, and is much more common in the male than in the female, as in the latter, from the peculiar construction of the urinary passages, there are fewer causes to produce it. The walls of these cysts are often much thickened by new deposits, and not unfrequently they contain calculous concretions. The bladder, in this state, is almost always irritable, and admits of very little distention. The number of sacs varies from one to six or ten.

We sometimes find the bladder *ulcerated*. Of this, I have seen several well-marked examples. In one, that of a young man of thirty, the ulcers, which were five in number, and situated around the mouth of the urethra, were of a circular shape, with reddened, elevated, and slightly undermined edges, reposing upon the submucous cellular tissue. The largest was an inch in length, by half an inch in width; the smallest about the size of a split pea. In several of these erosions there was an evident effort at reparation, as was indicated by the strongly adherent lymph which was stretched across their surface, and which gave them a rough, uneven appearance. The bladder itself was very much contracted, being scarcely larger than that of an infant, and contained about two ounces of thick, purulent fluid, resembling that which was found in the right kidney. Sometimes the ulcerative process extends through the muscular tunic, and the individual perishes from the extravasation of urine. In a few cases, the inner membrane of the bladder has been found entirely destroyed, the fleshy fibres being as bare as if they had been neatly dissected.

*Encephaloid* of the bladder seldom occurs as an original disease; most commonly it is propagated to it from the surrounding organs, as the rectum and the uterus. On the whole, however, it is a very rare disease, and is seldom witnessed except in old people. It appears to take its rise in the submucous cellular tissue; and, as it advances, it forms a large tumor, which projects into the cavity of the organ, and greatly diminishes its capacity. In some instances, as observed by Sir B. Brodie, it makes its way in other directions, passing outwards, and contracting adhesions with the sides of the pelvis, the uterus, or the bowels. Such tumors are sometimes of a mixed character, scirrhus, cartilaginous, and fungous; and, occasionally, they have been found studding the inner surface of the bladder in great numbers, not larger than a common pea, and of a soft medullary texture.

This disease is sometimes protracted for eight or ten years; but in the majority of cases it runs its course with great rapidity, destroying life in six or eight months. Frequent desire to void the urine, pain at the neck of the bladder, extending to the perinæum, and along the track of the urethra, and constant discharge of clotted blood, are the most prominent symptoms of the complaint. In the advanced stage of the disease, the urine is of a dingy brown



color, extremely offensive, and often contains fragments of medullary substance. The hemorrhage is occasionally quite abundant, and at length leads to fatal exhaustion.

The occurrence of *tubercle* in the urinary bladder is much less frequent than in the larynx, the trachea, or the intestinal canal. Indeed, it is among the rarest diseases to which this organ is liable. It is usually associated with tubercle of the kidneys, seminal vesicle, prostate gland, or other parts of the body, and appears to be most common in persons between twenty-five and fifty. The heterologous matter is deposited in small, discrete granules in the submucous cellular tissue, or in this substance and the mucous membrane, which is raised into little points, hard to the touch, and encircled by delicate vascular zones. The ulcers which are left by the softening of this matter are very small, and of an irregularly rounded form, with thin, ragged edges.

In old persons, of nervous, irritable temperament, the bladder is sometimes the seat of severe pain, darting through the pelvis in different directions, and recurring in regular paroxysms. In its nature, it is evidently *neuralgic*, and it is often associated with similar uneasiness in other parts of the body, especially the face and scalp. In some cases, it seems to be produced by sympathy with the kidney, or by an altered state of the urinary fluid.

The bladder, lastly, is subject to atrophy, a lesion which is sometimes congenital, sometimes the result of disease. It is most commonly seated in the muscular tunics, the fibres of which are extremely thin and pale; and it is apt to be attended with outward protrusion of the mucous membrane. Cases sometimes occur in which the bladder is totally absent, or where there is a deficiency of its anterior wall. This malformation almost always coexists with an imperfect development of the straight and pyramidal muscles, which, instead of passing down to the pubes, leave an aperture there, of greater or less extent, through which there is a constant trickling of urine. *Ectopia* is the term by which this state of the bladder is designated. Strong partitions are sometimes thrown across the interior of this organ, so as to divide it into several distinct chambers. They are frequently situated along the middle line, but now and then transversely; and when this happens, the bladder has a singular hour-glass contraction. These compartments, whether the result of disease, or of original malformation, generally communicate with each other; in some instances, however, they receive each a ureter, and open directly into the urethra.

Rupture of the urinary bladder, although certainly not common, is yet sufficiently frequent to render it an object of interest both to the pathologist and medical jurist. The causes which may give rise to this accident are, over-distension of the organ attended with softening of the mucous membrane and muscular fibres, gangrene and perforative ulceration, external violence, and, in the female, the pressure of the child's head during parturition. In whatever manner the laceration is induced, it is always followed by an escape of urine into the connecting cellular tissue, or peritonæal cavity, where its presence soon excites fatal inflammation. The period at which death takes place varies from a few hours to as many weeks, but the great majority of patients perish within the first three or four days. When caused by external violence, the lesion may be complicated with fracture of the pelvic bones, rupture of some of the parenchymatous organs, as the kidney, liver, or spleen, contusion of the skin and abdominal muscles, and more or less effusion of blood into the peritonæal cavity. The blood poured out sometimes amounts to several pounds, and may proceed from the laceration of a great number of small vessels, or

from the injury of a single large one. The size, situation, number, direction, and form of the accidental opening are extremely variable, and do not admit of any specific description. The ruptured organ is usually very much contracted, and rarely contains more than a few drachms of urine. When the lesion is the result of injury there is often no mark whatever of external violence, such as contusion or ecchymosis, a fact of great interest in a medico-legal point of view.

This organ is sometimes lacerated by causes apparently the most trifling. Zivinger\* attended a young man whose bladder was torn by a severe blow on the lower part of the hypogastric region, unaccompanied by the slightest appearance of external violence. A similar example is related by Zittmann.† Montagu‡ saw a case of rupture of this organ from a fall on the abdomen, and Dupuytren§ met with one where the lesion was produced by a kick in a scuffle. In this case the patient survived until the seventeenth day. On dissection, marks of adhesion were seen between the intestines and bladder, on the anterior surface of which existed two rents, one of them an inch and a half in length. Two instances of rupture of the bladder from violence are recorded by Dr. Cusack, in the second volume of the Dublin Hospital Reports. In one, the accident was caused by a fall from a height of twenty feet; in the other, by striking the hypogastric region forcibly against the edge of a bench. In both the rent was situated on the posterior part of the organ, which was quite empty, and very much contracted. In a case by Mr. Gamack|| the rupture was produced by the caving in of a bank of earth, causing two fissures, one at the fundus of the bladder and the other at its neck, close to the prostate gland.

The urinary bladder occasionally contains *worms*, which are either of a distinct and specific character, such as are found in no other situation, or they creep into it from the rectum, the colon, or the small intestine. In nearly all the recorded instances of the latter, the animal was of the lumbricoid or vermicular variety, which left its accustomed habitation, and passed into the urinary reservoir, either by perforating the coats of the alimentary canal, or, as more frequently happens, through an opening made by ulcerative absorption, from the irritation produced by an abscess, a piece of bone, or some extraneous body. The instances in which worms are said to have been voided from the bladder, under these circumstances, are very numerous; but as they possess no particular interest in a pathological point of view, they may, without disadvantage, be passed over in this place. Numerous references will be found in the third volume of Voigtel's "Handbuch der Pathologischen Anatomie."

Of the worms which naturally inhabit the urinary bladder, only two species have hitherto been discovered, the one by Mr. William Lawrence, the other by Mr. T. B. Curling, of London. The animal described¶ by the first of these distinguished surgeons, is the *spiroptera*, of which, in the space of about two years, a young, unmarried woman, twenty-four years of age, avoided not less than from eight hundred to a thousand. They varied in length from four to six inches, and were remarkably slender at the middle, from which they gradually increased towards the extremities, which were small and tapering. One of the surfaces of

\* Ephem. Nat. Cour., cent. vii., obs. 30.

† Op. cit., cent. v., obs. 22.

‡ Medical Communications of London, vol. ii., obs. 23, 1790.

§ American Journ. Med. Science, vol. xii., p. 535.

|| Medico-Chir. Review, vol. xvii., p. 510.

¶ Medico-Chir. Trans. of London, vol. ii., p. 385.

the body exhibited the appearance of a double row of small protuberances, while the other was marked by a groove with two rising edges. They were soft when first voided, and of a yellowish color. The body seemed homogeneous throughout, and careful microscopical observation failed to throw any light upon their organization. The smaller worms, which were seen only on one occasion, were semi-transparent, and of a rounded form, with pointed extremities. I am not acquainted with any instances in which this worm has been noticed in the human subject by other observers.

The worm discovered by Mr. Curling\* has been named by him *dactylius aculeatus*, from its peculiar ring-like appearance. It was voided with the urine, for a number of days, by a little girl, five years of age, who was affected with sub-acute pneumonitis, and who was also occasionally troubled with ascarides. The worm is of a light color, cylindrical in its form, annulated, and slightly tapering towards the extremities, particularly the anterior, which is the smaller. The female is four-fifths of an inch long (Fig. 189), the male two-fifths (Fig. 190).

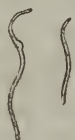
The head is truncated; the mouth orbicular; the neck distinctly annulated; and the tail, also annulated, is obtuse. The tegument, of a delicate transparent structure, and containing two layers of muscular fibres, one circular, and the other longitudinal, is armed with a number of sharp-pointed spines, arranged in equi-distant rows, in clusters of three, four, or even five. They cover nearly the whole surface, and seemed to be perfectly under the control of the animal, which has the power of protruding and retracting them at pleasure. The alimentary canal commences at the mouth

by three small convoluted tubes, which soon unite into a single one, which proceeds for some distance in a tortuous direction, when it becomes sacculated, and, enlarging as it descends, it terminates at the extremity of the tail in a trilobular anus.

The structure of the female is much more complicated than that of the male. The vulva is situated near the anterior extremity, about one-fifth of an inch from the head, and has the appearance of an opaque, mammillated process. The animal swells at this part, the tegument is thicker, there are no spines, and, for a short distance above and below the vulva, the body is encircled by a series of regular, dark-coloured fibres. About midway between the head and vulva, and on opposite sides of the alimentary canal, are two granular bodies, of an oval form, and just below these, two slightly convoluted tubular processes. No genital apparatus was discernible in the male. Both sexes have a distinct vascular, and, doubtless also, a nervous system. The annexed wood-cuts represent the internal structure of the worm. Fig. 191 is the male, Fig. 192 the female, both magnified ten times.

Having thus briefly considered the several lesions of the bladder, I shall bring this section to a close by making a few remarks on the nature of the vesical calculi and on the morbid states of the urine.

*Calculous concretions* are much more common in the urinary bladder than in any other organ of the body. Much diversity obtains in regard to their prevalence amongst individuals of different ages, and the inhabitants of different districts. Children are particularly prone to them, as are also persons who are far advanced in life; and men are much more frequently affected than women, owing, no doubt, to the more complicated construction of the urethra,



\* Medico-Chir. Transactions of London, vol. xxii., p. 274.



Fig. 191.

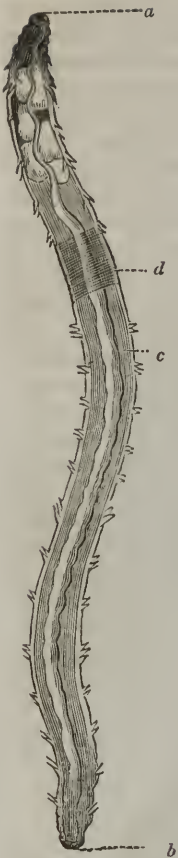
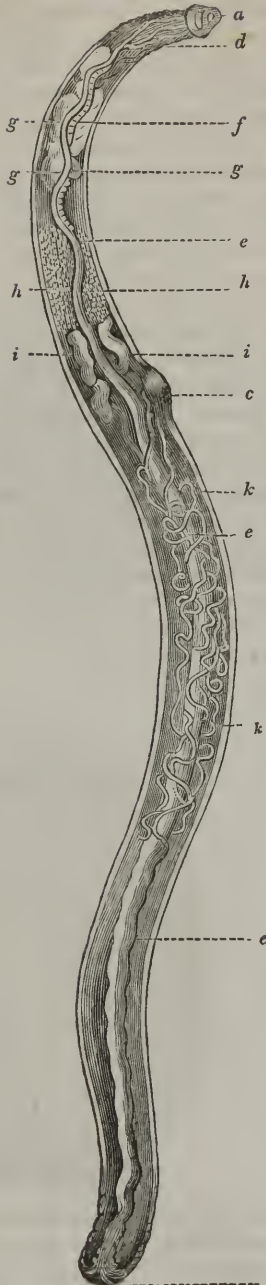


Fig. 192.



and to their more intemperate mode of living. In some instances the disorder seems to be of a hereditary nature, like the kindred diseases of gout and rheumatism, the calculous diathesis being transmitted from parent to child through several generations. Dr. Prout contends that hard, impure waters are favourable to the production of vesical concretions, from the changes which they are supposed to induce in the renal secretion. The explanation, however, is not very satisfactory, and the subject demands further investigation. Paralysis of the bladder, stricture of the urethra, enlargement of the prostate gland, injuries of the back in the region of the kidneys, and impairment of the digestive apparatus, especially of the stomach, may be enumerated as so many exciting causes of this disease.

The number of urinary calculi is extremely variable. Very frequently there is only a single one, whilst at other times there are a great many. Sir Astley Cooper met with one hundred and forty-two; Dessault with two hundred; Boerhaave with three hundred; Murat with six hundred and seventy-eight; and Physick with upwards of one thousand. This case occurred in a person of the late Chief Justice Marshall, and is perhaps the most remarkable of the kind on record. The concretions were all of an oval shape, and varied from the volume of a partridge-shot to that of a bean. When numerous, they are always more or less polished from continued friction against each other; and, although they generally lie perfectly loose in the bladder, it sometimes happens that they are encysted, impacted in the urethra,

Fig. 191 — *a*, The head; *b*, the caudal extremity; *c*, sacculated alimentary canal; *d*, dark lines at the junction of the anterior and middle third of the animal.

Fig. 192 — *a*, Head, with the orbicular mouth; *b*, caudal extremity, with the labiated anus; *c*, vulva; *d*, the three tubes by which the alimentary canal commences; *e*, alimentary canal; *f*, pulsating tube in the alimentary canal; *g*, lobulated bodies round the commencement of the alimentary canal; *h*, glandular bodies on the sides of the canal; *i*, movable fimbriated bodies near the vulva; *k*, convoluted oviducts.

or lodged in the ducts of the prostate. These concretions are of all sizes, from a hemp-seed to that of the fist; in their weight, they vary from a few grains to a pound or more, their average being from three drachms to an ounce.

Urinary concretions are generally arranged under different heads, according to their color, consistence, and intimate characters. Their chemical composition has attracted much attention during the last forty years, and the individuals who have particularly distinguished themselves for their researches in this respect are Scheele, Bergmann, Wollaston, Marcet, Fourcroy, and Prout. Much, however, as they have done, the subject is far from being exhausted; and an interesting field is still open, which, if properly cultivated, cannot fail to be of the greatest benefit. The subjoined arrangement includes the most important species of urinary concretions that have hitherto been described.

The *uric calculus*, the most common species of all, was first noticed by Scheele, in 1776. In its color it is brownish, inclining to that of mahogany, of a flattened, oval shape, occasionally finely tuberculated on the surface, but most generally smooth, though not polished, unless there are several concretions at the same time, and from the size of a currant to that of a hen's egg. If the uric calculus be divided with the saw, it will be found to consist of several layers arranged concentrically around a common nucleus, the laminæ being frequently distinguishable from each other by a slight difference in color, and sometimes by the interposition of other ingredients. Water has but little action upon it; it is perfectly dissolved by caustic potash; and disappears with effervescence in hot nitric acid, the solution affording, on evaporation to dryness, a bright carmine-colored residue; before the blow-pipe, it becomes black, emits a peculiar animal odor, and is gradually consumed, leaving a minute quantity of white, alkaline ashes. Fig. 193 shows the oval shape and finely tuberculated surface of the calculus; Fig. 194 the internal concentric layers.

Fig. 193.

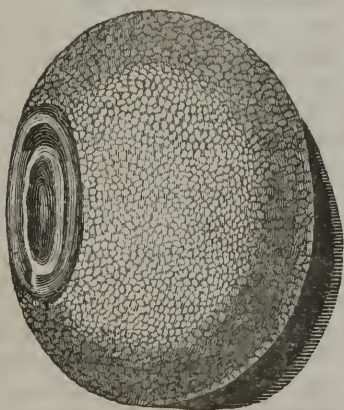


Fig. 194.



As a variety of the preceding, the *uro-ammoniac calculus* may be here mentioned. It is principally observed in children, and is so extremely rare that several distinguished chemists have been induced to deny its existence. It is generally of small size, with a smooth surface, of a clay color, and composed of concentric rings, which present a very fine earthy appearance when fractured. Much more soluble in water than the uric calculus, it gives out a strong ammoniacal smell when heated with caustic potash, and deflagrates



remarkably below the blow-pipe. This variety of calculous concretion was first described by Fourcroy.

Next to the uric calculus, in point of frequency, is the *oxalic*, which is generally of a dark brown color, rough and tuberculated on the surface, very hard, compact, and imperfectly laminated, seldom larger than a walnut, spherical, and always single. Under the blow-pipe, it expands and effloresces into a white powder; it dissolves slowly in muriatic and nitric acid, provided it be previously well broken up. In the alkalies, it is perfectly insoluble. This species of urinary concretion, called by many the *mulberry* calculus, from its resemblance to the fruit of the mulberry, was first correctly analyzed, in 1797, by Dr. Wollaston, who proved it to consist essentially of oxalate of lime. Figs. 195 and 196 show the external appearance and internal structure of this concretion.

Fig. 195.

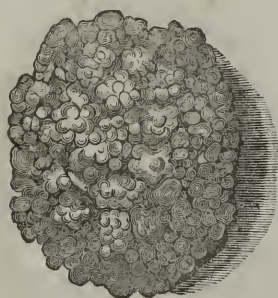


Fig. 196.



A variety of this species of calculus has been described by the term *hemp-seed*, from some resemblance which it bears in color and lustre to that substance. (Fig. 197.) It is always of small size, remarkably smooth, and generally exists in considerable numbers, being rarely if ever found alone.

Fig. 197.



The *phosphatic* calculus (Fig. 198), described by Wollaston in 1797, is of a pale brownish color, and of a loosely laminated structure, with a smooth, polished surface, like porcelain. The shape is mostly oval, and the size, though generally small, is sometimes very considerable. It whitens when exposed to the blow-pipe, but does not fuse; and readily dissolves in muriatic acid, without effervescence. This calculus, composed essentially of phosphate of lime, is extremely rare, as forming entire concretions, but frequently constitutes alternate layers with other matters. It is sometimes called the *bone-earth* calculus, and occasionally contains small quantities of carbonate of lime.

Fig. 198.



The next species is the *ammoniaco-magnesian*, so called from its being composed of the phosphate of ammonia and magnesia. (Fig. 199.) This mixed calculus is of a white color, friable, crystallized on the surface, and looks a good deal like a mass of chalk: its texture being never laminated, it easily dissolves in dilute acids, but is insoluble in caustic potash; before the blow-pipe, it exhales an ammoniacal odor, and at length melts into a vitreous substance. This species of concretion, first noticed by Wollaston in 1797, sometimes attains an immense size. In a case

Fig. 199.





mentioned by Dr. Thomson, the circumference was fourteen inches, and the weight nearly two pounds.

The *fusible* calculus, the nature of which was first determined by Wollaston, consists of a combination of the two last. It is of a white color, extremely brittle, leaves a soft dust on the fingers, and is easily separated into layers: when broken, it presents a ragged, uneven surface. It is insoluble in caustic potash, but gives off ammonia; and, under the blow-pipe, it is readily converted into a transparent, pearly-looking glass. This concretion is very common, and sometimes attains a very large size. It is frequently met with as an incrustation of foreign bodies. Figs. 200 and 201 exhibit the outer appearance and internal structure of this concretion.

Fig. 200.



Fig. 201.



A very rare species of urinary concretion is the *cystic*, so called from an erroneous supposition that it was peculiar to the bladder. It consists of a confused, crystallized mass, of a white, yellowish color, with a smooth surface. The structure is compact, and the fracture exhibits a peculiar glistening lustre, like that of a body having a high refractive density. It exhales a strong characteristic odor under the blow-pipe, and is very abundantly dissolved in acids and alkalies, with both of which it crystallizes. This species is commonly of an irregular, spherical shape, and seldom attains a large volume. Wollaston termed it an oxide, and gave it the name of cystic,

Fig. 202.

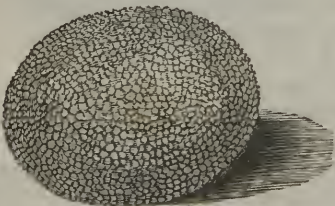
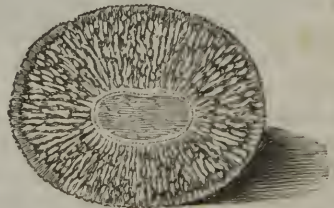


Fig. 203.



from a belief that it occurred exclusively in the urinary bladder. It has since been detected, however, in the kidney. The external and internal appearances of the cystic calculus are shown in Figs. 202 and 203.

The *xanthic* calculus was first pointed out by Dr. Marcet, whose account of it is the best that is extant. It is extremely rare. Its texture is compact, hard, and laminated: its color is of a cinnamon brown, its surface smooth, and its volume small. It dissolves very readily in acids and alkalies, and is gradually consumed before the blow-pipe, leaving a minute quantity of white ashes.

There is, lastly, what is called the *fibrinous* calculus. Like the preceding species, this is also extremely rare, and appears to be composed principally of the fibrin of the blood, a property to which it owes its name, and by which it is characterized. Sir Benjamin Brodie\* has described a concretion of this kind, which was about the size of a horse-bean, of an oval shape, and of a yellow transparent appearance, not unlike amber, but less hard. When dried, it shrunk to a small size, and became considerably shrivelled.

Such is a succinct account of the relative frequency of the different species of urinary concretions, their physical properties and chemical composition. In many cases they are formed in the kidneys, whence they descend into the bladder, where they gradually acquire the characters that have just been ascribed to them; but at other times they take their origin entirely in the urinary reservoir, and not unfrequently they grow around a foreign body as their central nucleus. A substance like mortar is occasionally contained in the bladder, filling up a large portion of its cavity. It is of a pale yellowish color; is composed principally of phosphate and carbonate of lime; and is usually connected with chronic inflammation of the lining membrane, leading to effusion of lymph. Hair is sometimes found in the softer varieties of urinary calculi, but this is very rare. The immediate cause of the formation of vesical calculi consists in the inordinate deposition of the earthy salts of the urine, which, instead of being discharged with that fluid, sink to the bottom of the bladder, and so become the nuclei around which the accretion gradually takes place.

Almost any foreign substance, as a drop of blood, a mass of inspissated mucus, a shot, or a ball, may serve as a nucleus for calculous concretions. My friend Professor Parker, of New York, operated upon a case a few years ago in which the stone was formed round a piece of slippery-elm bougie. In my private collection is a specimen, presented to me by Dr. Jetton, of Sumner county, Tennessee, which contained three of the caudal bones of a squirrel. The supposition is, that the man, who was thirty-five years of age, had been in the habit of exciting onanism with the tail of this animal, and that in one of these attempts a portion of it broke off, and slipped into the bladder. A considerable number of examples, in which bits of catheters, seeds of vegetables, fruit stones, pins, bodkins, and even needles, formed the centre of urinary calculi, are upon record. Such cases are, for obvious reasons, more frequent in the female than in the male.

The symptoms of stone vary in different cases, according to the size of the concretion, the roughness of its surface, and the accompanying state of the bladder. When the disease is fully developed, there is a frequent desire to make water, the calls to which are often sudden, irresistible, and liable to be induced by the slightest change of posture. A small aching pain is usually felt at the neck of the bladder, which, extending along the urethra, is always most severe immediately after micturition, or during the flow of the last drops of urine. Itching of the head of the penis is a very common and distressing symptom, and is usually more distinctly marked in children than in adults.

\* Lectures on the Urinary Organ, p. 214, second edition London 1835

The urine is frequently tinged with blood, especially after exercise ; and, as it flows from the bladder, it is liable to be stopped by the stone falling against the inner orifice of the urethra. Along with these phenomena are often observed uneasy sensations in the perinaum, groin, testicle, and lumbar region, with a peculiar expression of suffering and anxiety in the patient's countenance. Tenesmus is sometimes experienced from the propagation of the irritation to the rectum ; and the urine, upon settling, generally deposits a considerable quantity of mucus. The only diagnostic sign, however, is the recognition of the stone by the sound.

There is no fluid which, even within the limits of health, is liable to so many variations in its physical and chemical properties as the urine. Its quantity, also, is extremely uncertain, as it is influenced by numerous causes, especially by the state of the skin and the amount of liquids received into the stomach. On an average, however, a healthy person voids about forty ounces in the twenty-four hours. When perfectly normal, the urine is of a pale amber color, transparent, saline in its taste, and slightly aromatic in its odor. It is of the average specific gravity of about 1.025; is supposed, from its giving a red tint to litmus paper, to contain a free acid ; and deposits, on standing, an insoluble substance, consisting of mucus and the super-urate of ammonia. The quantity of solid matter that passes off by this excretion daily is about sixteen drachms, and does not seem to be subject to much variation.

The most elaborate analysis of this fluid is by Berzelius. According to this distinguished chemist, 1000 parts of urine are composed of

Water	-	-	-	-	-	-	-	-	933.00
Urea	-	-	-	-	-	-	-	-	30.10
Uric acid	-	-	-	-	-	-	-	-	1.00
Sulphate of potash	-	-	-	-	-	-	-	-	3.71
Sulphate of soda	-	-	-	-	-	-	-	-	3.16
Phosphate of soda	-	-	-	-	-	-	-	-	2.94
Phosphate of ammonia	-	-	-	-	-	-	-	-	1.65
Muriate of soda	-	-	-	-	-	-	-	-	4.45
Muriate of ammonia	-	-	-	-	-	-	-	-	1.50
Phosphate of lime and magnesia	-	-	-	-	-	-	-	-	1.00
Siliceous earth	-	-	-	-	-	-	-	-	.03
Vesical mucus	-	-	-	-	-	-	-	-	.32
Free lactic acid, lactate of ammonia, and animal matter not separable from them	-	-	-	-	-	-	-	-	17.14

Besides these ingredients, the urine likewise contains a small amount of sulphur, phosphorus, and a peculiar yellow coloring matter, which has not yet been obtained in a separate state. In the urine of infants there is also generally some benzoic acid.

Such, then, in a few words, are the characters of this excretion in the normal state of the system. But, as might be expected, this fluid undergoes great changes in various disorders of the body, which may be conveniently reduced, as has been suggested by Andral, to three classes. Under the first category are comprised those cases in which there is merely deficiency or excess of the natural constituents of the urine; in the second, there is an addition of new principles, analogous to those that are contained in the blood; and under the third head are embraced such substances as are deposited with the urine, but are not found in the circulating fluid, either in the healthy or diseased state. Each of these classes affords interesting topics of inquiry,



which demand brief consideration in this place, referring for more ample details to the excellent treatises of Berzelius\* and Prout.†

1. Water and urea, being naturally present in greatest abundance, are more liable to variation than any of the other constituents of the urine. In nervous diseases, especially such as are of a hysterical nature, this secretion is generally copious, remarkably limpid, and of an aqueous character. In *diabetes insipidus*, the urine, which is discharged in immense quantities, is almost wholly composed of water; the urea is entirely absent; and the fluid, on evaporation, leaves a yellow-brownish syrup, in which there is no appearance of crystals, and which possesses a very feeble acid reaction. Urea is furnished sparingly in chronic inflammation of the liver, in the granular disease of the kidney, in dyspepsia, pulmonary phthisis, gout, and intermittent fevers. This substance has been supposed, but erroneously, to be wanting in diabetes mellitus. Both Barruel and Henry have shown that it is generally present, and they suppose that the error into which other chemists have fallen in respect to this matter, has arisen from the tendency which the sugar has to prevent the nitrate of urea from crystallizing. Urea sometimes exists in excess. This state is usually combined with preternatural activity of the renal function, and can be easily recognized by mixing with the urine an equal quantity of nitric acid.

The lactic acid, which, according to Berzelius, naturally exists in the urine, is seldom or never altered either in quantity or quality. But this is not the case with the uric and phosphoric. The former of these, supposed by Dr. Prout never to be present in healthy urine, generally greatly predominates in arthritic affections, as is shown by the formation of the earthy concretions, which are so frequently seen in the joints of the extremities, and which seem to be composed principally of the urate of soda, with a small quantity of the urate of lime. Gravel commonly consists of uric acid, and it is well known that this substance forms the basis of one of the worst kinds of urinary calculi. In diabetes mellitus this acid is entirely absent, no trace of it whatever being discoverable by the most delicate tests.

In some instances this acid occurs in a free state; but most generally it appears in combination with an alkali; and, so long as this is the case, it does not yield a crystalline deposit. The undue secretion of this substance is usually produced by errors in diet, and by whatever has a tendency to impair the digestive powers. Hence it is most commonly met with in dyspeptic persons, of a gouty, irritable habit, in whom it sometimes prevails to a most unhappy extent, constituting a sort of uric acid diathesis.

A deficiency of phosphoric acid is not less injurious than an excess of uric. Prout supposes that, when this acid is not secreted in due proportion, the earthy materials of which it is the base are converted into neutral salts, and then precipitated, so as to afford an opportunity for the formation of a stone.

The alkalies which enter into the composition of this fluid are sometimes secreted in excess, and, by combining with the acid ingredients, may form salts, which, on being deposited in the bladder, give rise to calculous concretions. This is especially the case with the lime and ammonia, the soda and potash producing little or no inconvenience.

2. The process of secretion, which is constantly going forward in the kidney, sometimes proceeds to a morbid extent, in consequence of which substances

\* *Traité de Chimie*, t. vii. Paris, 1833.

† *Inquiry into the Nature and Treatment of Gravel*, &c.

are generated which do not naturally occur in the urine. The most important of these, in reference to the pathology and treatment of diseases, are albumen, fibrin, and the coloring matter of the blood. Other substances are occasionally observed, which get into the urine accidentally, and impart to it their peculiar properties. Of this description are the yellow matter of the bile, asparagus, oil of turpentine, and most of the balsamic preparations. Cantu detected mercury in the urine of persons who had been subjected to frictions with that substance, in the form of ointment; and the ferro-cyanate of potash, tartaric acid, iodine, and a hundred other articles have been observed by different chemists in this fluid, after they had been used as medicines.

In severe cases of jaundice, whether resulting from duodenitis, inflammation of the liver, or obstruction of the natural outlets of this organ, the bile passes from the blood into the kidneys, and communicates a yellow tint to the urine, at the same time that it renders it more acid. The most delicate test of its presence is muriatic acid, which causes either a green or brownish hue, according to the peculiar modification of the coloring principle of the foreign ingredient. Linen and paper will receive a very distinct yellow stain, which remains when dried. The muriate of iron and the acetate of lead produce a yellow precipitate, the sulphate of copper, a dirty green one.

Albumen is said by some to be always contained in very minute quantity in healthy urine; but, however this may be, this substance is frequently present in certain diseases, in large proportion. In the granular affection of the kidney, so ably elucidated by Dr. Bright, albumen generally exists in considerable quantities, though it cannot be regarded as pathognomonic of that singular lesion, as it has been repeatedly observed in pneumonitis, dropsy of the abdomen, tubercles of the lungs, prurigo, and typhoid fever. Both Bouillaud and Piorry declare that they have frequently noticed this substance in diseases which had no connection whatever with the urinary organs. According to Dr. Blackall, it is characteristic of certain kinds of dropsy, especially such as are accompanied with a phlogistic diathesis,—an opinion which has been amply confirmed by the researches of other pathologists.

Albuminous urine is generally of low specific gravity, from deficient quantity of urica and salts, of a pale, opaline color, and readily coagulable on exposure to heat. The ferro-cyanate of potassium, alum, and nitric acid will also curdle it.

The urine may also contain fibrin; but this, I presume, is very rare; at all events, the subject is seldom alluded to by writers. Dr. Prout saw a remarkable instance of this deposit, in a middle-aged woman, who had a most voracious appetite, but was otherwise perfectly healthy. Her urine, which was of a pale yellow tint, was extremely thick, and contained a large quantity of matter, which bore the greatest resemblance to the fibrin of the blood. The appearance of this substance is occasionally associated with certain forms of dropsy; but how it is produced it is impossible, in the present state of our knowledge, to determine, as nothing is yet certainly known respecting it. Perhaps it may depend upon some structural lesion of the kidney, that has hitherto escaped the attention of the anatomist, or it may be that it is connected with a sort of inflammatory diathesis, either of the renal tissues, or of the system at large.

The coloring matter of the blood is sometimes found in the urine. It may get into it either in consequence of external violence, giving rise to the laceration of some of the vessels of the urinary organs; or it may be a product of exhalation of the mucous membrane; or, finally, a secretion from the kidney.

A substance, termed *kiestine*, was detected in the urine a few years ago by Nauche. He supposed it to be peculiar to pregnant women, but it has since been ascertained to be generally present also during the early months of lactation, and sometimes also in the virgin state. When first observed it usually presents itself in the form of little isolated patches, which gradually coalesce, and form a pellicle, from half a line to a line in thickness, of a whitish opaline tint, not unlike the greasy scum upon the surface of fat broth. Dr. Elisha K. Kane,\* who has carefully investigated the physical properties of this substance, states that it occasionally makes its appearance in striated irregular lines, somewhat similar to those of a spider's web, in rings, circles, trapeziums, and irregular figures of almost every shape, which become gradually obscured by the full development of the pellicle. It consists of a filamentous, flaky tissue, and is so coherent that it may occasionally be lifted off entire from the fluid which it covers. A portion of this substance commonly subsides, and forms a thin, bluish, or whitish layer at the bottom of the vessel. Its chemical nature has not been determined. Its smell sometimes resembles that of old cheese, but this is far from being constant. The time at which the pellicle appears varies. Dr. Kane has seen it well-marked at the end of thirty-six hours, and, on the other hand, he has known its appearance to be postponed until the eighth day.

3. In the third place, the urine may be altered by the ingress of principles which, so far as we know, are not naturally contained in the blood. Amongst these, the most common are the cystic and xanthic oxides, oxalic acid, and a peculiar saccharine substance, like the sugar of grapes. The cystic and xanthic oxides are never observed in healthy urine: they form the base of several varieties of vesical concretions, and the causes which predispose to their development are still unknown. Oxalic acid is more frequently seen, and is often traceable to articles of diet, which naturally possess a large quantity of this substance.

An abundant secretion of sugar is a circumstance by no means uncommon. In *diabetes mellitus*, where it is generally present in large proportion, it forms the characteristic feature of the disease. The urine in this complaint is commonly of a pale straw color, of a faint, whey-like odor, and of a decidedly saccharine taste; it has a greater specific gravity than in health, yields a syrup by evaporation, has little tendency to putrefy, and is susceptible of undergoing the vinous fermentation. Diabetic urine almost always contains the usual proportions of saline matters; but, in the majority of cases, there is a great deficiency of urea and lithic acid. In a specimen of this fluid, examined by Mr. Kane, of England, 1000 parts were found to be composed of 913 of water, 60 of sugar, 7 of urea, and 20 of salts.

The quantity of urine discharged in diabetes is sometimes surprising. Cases are on record, in which from two to four gallons have been voided every twenty-four hours for a number of weeks, and even months. The amount of saccharine matter is also very great. From some observations of Dr. Henry, of England, it appears that ten pints of diabetic urine, of the specific gravity of 1.040, contain upwards of a pound and a quarter of solid extract. The proximate cause of this disease is still unknown. From the facility with which the saccharine matter is furnished by the kidneys, it has been supposed to exist in the blood. No chemist, however, has hitherto succeeded in detecting it in this fluid; and, until this be done, it would be idle to indulge in speculation. The kidneys are generally large and flabby, and there is almost always great disorder of the digestive apparatus.

\* Amer. Jour. Med. Sciences, vol. iv., p. 13, N. Series.



Though *oil* is not contained in healthy urine, it is found in certain diseases. In one instance, Prout observed a substance like butter; and, in some cases, the fluid has the aspect of milk. Of oily urine, Raciborski has pointed out three varieties. In the first, the fluid is of a reddish yellow color, and of a viscid, ropy consistence; in the second, it is of a mahogany brown. When this appearance is witnessed in acute diseases, it is always indicative, according to Landré-Beauvais, of great danger; in the third, the fatty matter floats on the surface of the urine, forming a thin pellicle, not unlike a spider's web.

The urine is occasionally of a *bluish* tint, owing to the presence of a peculiar coloring matter, which it holds in suspension. This substance, whatever may be its nature, is slightly soluble in boiling water and alcohol, has neither taste nor smell, and is entirely destroyed by nitric acid. Exposed to heat, it yields carbonate of ammonia, and an empyreumatic oil.

The urine may likewise be of a *black* color, from the presence of melanic acid. When this substance is very abundant, the fluid has sometimes the appearance of black ink, or may be made such by the addition of an alkali. More frequently, a pink color is observed, which is supposed by Dr. Prout, to be owing to the presence of purpuric acid. Raciborski has often noticed this tint in rheumatic affections of the joints, of which, however, it is far from being diagnostic; and he has also witnessed it, though much less frequently, in catarrhal complaints of the chest.

The urine, under certain circumstances, deposits amorphous sediments, which Dr. Prout has arranged into several classes, the difference of color forming the basis of the division. They all consist essentially of the lithate of ammonia, tinged with the coloring principle of the urine, or the purpurates of ammonia and soda. The yellow sediment is characteristic of health; the pink, of hectic; the lateritious, of inflammatory fever. To this statement, however, there are numerous exceptions.

Lastly, the urine may contain hairs. Of this singular occurrence, highly interesting cases have been published by Magendie, Brodie, and some other writers. The hairs, which are occasionally quite numerous, are seldom more than five or six lines in length, and they generally appear in combination with an excessive secretion of earthy matters. Whence these hairs are derived, we have no means of ascertaining. The subjects of most of the cases that have been reported, were old men of intemperate habits.

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## SECTION V.

### OF THE PROSTATE GLAND.

The prostate gland, situated at the inferior part of the neck of the urinary bladder, is a small conical body, of a firm consistence, yet easily compressed, and of a greyish color, bordering upon red. Its weight, in the adult human subject, although liable to considerable variation, is generally found, according to my own examinations, not to exceed five drachms. In length it is ordinarily about twenty-one lines, by eighteen in breadth, and nine in thickness. Larger behind than in front, it consists of two lateral halves, which are separated posteriorly by a deep notch, in the upper part of which, at the origin of the

urethra, lies the small pyramidal tubercle, which Sir Everard Home has described as the third lobe of the prostate, but which, in the generality of cases, seems to be merely a portion of the body of the gland, in a state of hypertrophy. Enveloped by a strong capsule, the organ is composed of a dense, fibrous substance, of a white greyish tint; in the interior of which are a large number of mucous follicles, which pour their contents, by means of ten or a dozen ducts, upon the inner surface of the prostatic portion of the urethra, at each side of the gallinaginous crest.

The prostate is liable to inflammation, suppuration, ulceration, hypertrophy, enlargement of its ducts, tubercular deposits, and earthy concretions.

*Acute inflammation* of the prostate is rather a rare disease, especially in the young. Its anatomical characters are increased vascularity, and deep redness, with tumefaction, serous infiltration, and preternatural lacerability. The disease is generally induced by an extension of irritation from the neighboring parts, as the urethra, perinæum, or rectum, and is always marked by great distress in the neck of the bladder, difficult micturition, dull, aching pain in the pelvic cavity, and numbness in the groin and thigh. The urine is hot and scanty, and sometimes, especially when there is much swelling of the prostate, there is complete obstruction to its evacuation.

*Suppuration* is commonly the result of acute inflammation, though occasionally it supervenes on the chronic form of the disease. The matter, which is ordinarily of a thick, creamy consistence, and of a pale straw color, is sometimes diffused through the substance of the gland; but more frequently it is collected into little abscesses, which have a natural tendency to burst into the urethra, the bladder, or the rectum. In some instances, the fluid finds an outlet through the perinæum. Occasionally the abscesses attain a very considerable size, containing from one to three ounces of pus. Suppuration of the prostate is seldom seen before the age of twenty; but from this period on it is by no means infrequent. Its existence may be suspected by a variety of symptoms; the only certain sign, however, is the sudden discharge of pus with the urine.

When the inflammation becomes chronic, it sometimes terminates in *ulceration*. The erosions generally exist on the vesical surface of the gland; and as they are constantly in contact with the urine, they often give rise to the most intense suffering. Their edges are usually hard and irregular, and their depth is frequently such as to render it difficult to pass the catheter. When these ulcers are extensive, they are liable to bleed, the hemorrhage being generally small, but sometimes copious and alarming.

*Chronic inflammation* is much more common than the acute, of which it is occasionally the result. The affection is very frequent in the decline of life, and in persons who are suffering from calculous disorders, or disease of the rectum. The most ordinary effect of this species of irritation, in relation to the proper structure of the gland, is *hypertrophy*. The enlargement is sometimes very great, exceeding many times the natural size, and is commonly much more conspicuous on one side of the organ than on the other. Often it is entirely confined to the third lobe, which projects upwards into the cavity of the bladder, like a big nipple. The enlargement is sometimes unattended with alteration of texture; in most cases, however, it is remarkably hard and firm, presenting a dense, gristly substance, of a whitish-brown color, with membranous bands extending through it in different directions. This constitutes the *scirrhus* prostate of authors. The vessels in the neighborhood of the gland are often very much enlarged, and even quite varicose.

The usual form of hypertrophy of the middle and lateral lobes of the pro-

state is given in Fig. 204. In Fig. 205 the middle lobe is uncommonly large,

Fig. 204.

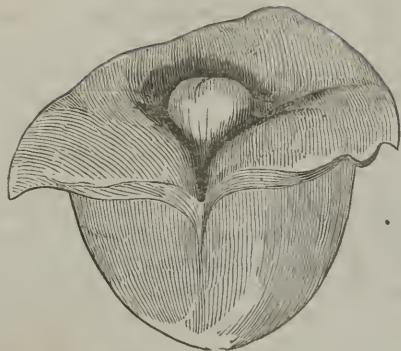
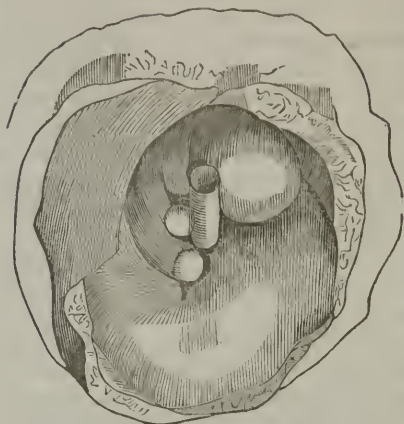


Fig. 205.



and presents two round globular tubercles on the left side. The drawings are from specimens in my cabinet.

This hypertrophous state of the prostate is always attended with difficult micturition, resulting from the mechanical obstruction which it produces at the mouth of the urethra. The urine has to be drawn off with the catheter, and even this often fails in entirely emptying the bladder, the fluid which lies behind the enlarged gland, in the *bâs-fond* of the organ, escaping the instrument. When the disease is obstinate, as, in fact, it usually is, the patient is not only tortured with retention of urine, but he suffers from disease of the rectum, which in consequence of the frequent straining efforts which he is obliged to make, is everted at the anus; the penis is often in a state of partial priapism; at night, there are involuntary seminal emissions; severe pains dart along the groin and urethra; there is a dull, aching sensation in the perinæum; and, in obstinate cases, œdema of the scrotum and inferior extremities. The bladder, in most instances of this kind, is excessively irritable; it becomes small and contracted, and, from the great exertion which it is constantly obliged to make to expel its contents, its middle tunic is often very much thickened, the muscular fibres being rendered as distinct as the fleshy columns of the heart. The mucous secretion is thick and viscid, and not unfrequently mixed with blood, or even purulent matter. The kidneys are also liable to become affected, and the patient sometimes falls a victim to the disease which is thus lighted up in them.

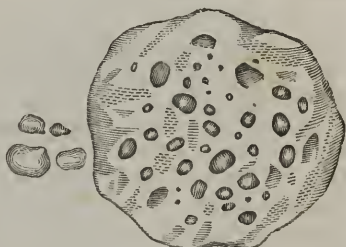
A very rare affection of this gland is sometimes met with, which, until recently, seems to have entirely escaped the attention of the pathological anatomist. I allude to the *dilatation* of the excretory ducts of the prostate, forming small pouches which may arrest the beak of the catheter, or become depôts of earthy concretions, or urinary calculi. The sacs are seldom numerous, and they vary in size between a cherry and a marble: sometimes they attain a magnitude capable of holding several ounces; and cases occur in which the whole of one lobe, or even the entire organ, is converted into a thin, fibrous capsule, the proper substance of the gland being almost wasted. This lesion most commonly occurs in old persons, in connection with urinary calculi and chronic enlargement of the prostate.



The prostate is occasionally the seat of *tubercles*. Of this disease, I have seen but one example, in a young man who died of psoas abscess, in the Cincinnati Hospital. There were six or eight small masses, of a pale yellowish color, and of a soft, curdy consistence, scattered through different parts of the gland, which was at the same time considerably reduced in size. The deposition of tubercular matter here is commonly associated with pulmonary phthisis: it seldom occurs under the age of forty-five or fifty, and appears to have a decided predilection, so to speak, for the follicular structure of the gland.

I have repeatedly met with *earthy concretions* in the prostate. (Fig. 206.) Their composition is invariably phosphate of lime, with a little animal matter. In their size, they vary between a mustard-seed and a hazelnut; they are of a rounded figure; their surface is smooth and polished; and their color of a yellowish-brown. These bodies often exist in considerable numbers, being either embedded in the substance of the gland, or situated in the dilated ducts. In one case I found them of a regularly pyramidal figure. They rarely cause much uneasiness, and hence their presence is not always suspected during life. Occasionally they create retention of urine; and, in some instances, their existence has been detected by the sound, or by the finger introduced into the rectum.

Fig. 206.



A few examples of *encephaloid* of this gland have been recorded. One, in which this affection occurred in a child five years of age, has been lately published by Mr. Stafford, of London, in the twenty-second volume of the Medico-Chirurgical Transactions. The gland was somewhat globular in its form, and equal in size to the largest walnut, with a round, nipple-like projection, about the volume of a hazelnut, in the situation of the middle lobe. On cutting through the lateral part of the tumor, it was found to be converted into encephaloid substance, interspersed with a small quantity of melanotic matter. The kidneys were large and flabby; the mucous membrane of the bladder was somewhat thickened; and the organ contained about an ounce of urine mixed with purulent matter.

When we reflect that the prostate gland, in a child five years old, is scarcely as large as a hazelnut, we shall be struck with the immense volume which it attained in the above case. The most distressing symptom was retention of urine.

## CHAPTER XXVI.

### OF THE MALE ORGANS OF GENERATION.

#### SECTION I.

##### OF THE TESTICLE.

I. *The Testicle*. — Observations respecting its Coverings, Weight, and Volume. — Diseases of its Vaginal Tunic. — Inflammation. — Hydrocele. — Hematocele. — Earthy Concretions. — Or-

chitis. — Malignant Affections of the Testicle. — Tubercles and Hydatids. — Hypertrophy and Atrophy. — II. *The Spermatic Cord*. — Encysted Dropsy. — Varicocele. — Neuralgia. — III. *The Seminal Vesicles*. — Their Lesions, few in number and still involved in obscurity. — Tubercles. — Earthy Concretions. — IV. *The Scrotum*. — Carcinoma. — Excessive Enlargement. — Is sometimes affected with a peculiar sloughing Ulcer. — They contain foreign substances, such as Teeth, Hair, and pieces of Bone. — Earthy Concretions. — V. *The Penis*. — Gonorrhœa. — Gleet. — Chordee. — Organic Stricture. — Abscess along the course of the Urethra. — Malformations of this tube. — Imperforation. — Morbid Erection of the Penis. — Degeneration of the Pectiniform Septum and Fibrous Sheath. — Carcinoma. — Syphilitic Ulceration. — Experiments of Ricord. — Herpetic Affections. — Warty Excreescences. — Phymosis and Paraphymosis. — Sometimes seat of calculeous concretions.

THE testicle, suspended in the scrotum by the spermatic cord, is of an ovoidal figure, and surrounded by two envelopes; the one of a fibrous, the other of a serous structure; the former giving it firmness, the latter, usually termed the vaginal tunic, enabling it to execute its various movements. In the adult, it is generally, according to my own measurements, about twenty-two lines in length, by eighteen in breadth, and seven in thickness. Its medium weight, I have found, in a considerable number of subjects, to be about five drachms, — the minimum being three and a half, and the maximum six and a half. The weight of the epididymis generally ranges from two to three scruples. In its consistence, it bears a strong resemblance to the ball of the eye; externally, it is of a white greyish color, owing to its fibrous covering; and, when cut into, it is found to consist of a soft, yellowish, pulpy substance, arranged into small pyramidal masses, composed each of a coiled string of seminiferous tubes.

The diseases of the testicle are numerous and important, and they may be conveniently considered with reference to its serous investment, and its proper parenchymatous texture.

I. The principal lesions of this membrane are, acute and chronic inflammation, suppuration, hydrocele, induration, hæmatocele, fungous growths, cartilaginous and osseous transformations.

Acute inflammation of the vaginal tunic exhibits the same phenomena precisely as the serous textures in other situations. There is more or less redness, with effusion of serum, fibrin, pus, or blood; and not unfrequently the contiguous surfaces of the membrane coalesce by the adhesive process. The water that is poured out by the vessels is either absorbed or remains until it is drawn off by a surgical operation.

Suppuration of this membrane is very rare, except as a consequence of hydrocele and its treatment. The matter is generally of a yellowish straw color and when allowed to stand, separates into two parts, one of them thin and watery, the other thick and purulent.

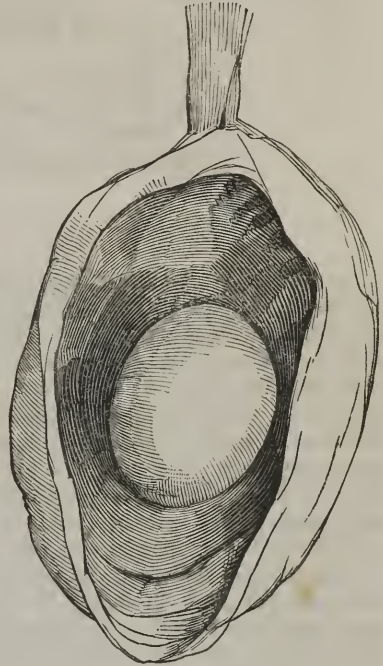
Chronic inflammation of the vaginal tunic is of frequent occurrence in the inhabitants of warm climates, and in persons who are subject to diseases of the urethra and prostate gland. It is characterized by opacity and thickening of the inner surface of the membrane, and by the effusion of different kinds of fluids, especially such as are of a serous nature.

The vaginal tunic is naturally lubricated by a thin vapor, just sufficient for the easy movement of the testicle. In inflammation this vapor becomes condensed, and thus leads to the formation of what is named *hydrocele*. Fig. 207 represents the appearance of a tumor of this kind from a preparation in my private collection. The quantity of fluid seldom exceeds eight or ten ounces; but may amount to several quarts. Gibbon, the historian, had a hydrocele which contained a gallon and a half, and an instance is recorded where it amounted to forty pounds.\* From a table constructed by Dr. Dujat of 1000

\* Act. Erudit. Lipsiens, 1725, p. 492.

cases of this disease, treated at the Native Hospital of Calcutta, it appears that the quantity of serum evacuated varied from less than ten to upwards of one hundred ounces. Of 370 cases of double hydrocele the fluid was more abundant on the right side in 109, and on the left side in 128. Of the 630 cases of single hydrocele, the quantity of fluid, in rather more than a third of the number, was under ten ounces; in two-sevenths it was from ten to nineteen ounces; in nearly a third from twenty to forty-nine; and in eighteen cases from fifty to one hundred and twenty ounces.\*

Fig. 207.



The appearance of the water varies a good deal according to the duration of the disease. In young subjects, and in recent cases, it is generally clear and limpid; but under opposite circumstances it is of a pale straw, yellowish, amber, or citron color, or of the color of pale sherry-wine. More rarely the fluid is of a red or brownish tint, from the admixture of hæmotosine. In some instances it is of a lactescent appearance, and Velpeau in one case found it perfectly green. In its consistence it commonly resembles water, but it may be thick, and almost as firm as jelly. When the disease is of long standing, and dependent on organic lesion of the testicle, the accumulated fluid is often purulent. In a case in which I operated several years ago, I drew off nearly two quarts of pus and serum, of a very fetid character. White, flaky particles, soft, friable, and micaceous, or greasy, like adipocire, and composed of cholesterine, are likewise occasionally contained in the fluid of hydrocele. Dr. Bostock has suggested, with apparent probability, that these small particles are not the direct result of secretion, but the product of a chemical change in the effused liquid, similar to that by which adipocire is formed from flesh when subjected to protracted maceration in water.

The water of hydrocele is usually devoid of odor, but has a marked saline taste, and is coagulated by heat, alcohol, corrosive sublimate, and the dilute acids; circumstances which clearly show its close affinity with the serum of the blood, from which it is derived. From the analysis of Dr. Bostock,† the most accurate that has yet been made, it appears that 100·00 parts of the fluid of hydrocele, of the specific gravity of 1024, consist of

Water	-	-	-	-	91.25
Albumen	-	-	-	-	6.85
Uncoagulable matter	-	-	-	-	1.1
Salts	-	-	-	-	.8

---

100·00

\* Curling, *Practical Treatise on the Diseases of the Testis*, p. 153; *Gazette Médicale de Paris*, 1838, p. 562.

† *Med. Chir. Trans.*, vol. iv., p. 53.



In a case of hydrocele in which the fluid was of a dark grumous appearance, and intermixed with brilliant crystalline flakes, Brett and Bird\* found 500 parts contain

Water	-	-	-	-	441.50
Albumen and coloring matter of the blood	}				51.07
Cholesterine					5.40
Animal matter and salts soluble in alcohol	}				.90
Animal matter soluble in water					.76
Salts	-	-	-	-	.37
					<hr/> 500.00

In recent hydrocele, the vaginal tunic is commonly unaltered; in old ones, on the contrary, it is apt to become hard, opaque, and thickened. Occasionally the inner surface has a rough, pitted aspect, from the effusion of lymph; and sometimes, though rarely, narrow bands extend from it to the testicle. The membrane may be partially ossified, or transformed into a hard gristly substance, which generally presents itself in the form of greyish, opaque patches, of various shapes and sizes. Loose bodies, of an oval figure, usually not larger than a pea, and of a fibrous, cartilaginous, or bony character, have been found in the sac; occasionally the fluid is contained in separate cells, or compartments, as in ovarian dropsy, and Richter, Morgagni, and other pathologists speak of cases in which it was intermixed with serous cysts.

The albugineous coat is much less liable to suffer in hydrocele than the vaginal. It may, however, be variously affected, particularly in cases of long standing, or where the complaint is complicated with organic disease of the testicle. The most common changes are, increased thickness, induration, and the cartilaginous transformation. It has been found partially ossified, or studded with earthy concretions; it may also be the seat of fungous tumors, serous cysts, and warty excrescences.

The testicle may be perfectly healthy, or it may be changed in its size, form, and consistence. In recent cases, when the accumulation is very small, the alteration, if any, is proportionably slight; but when the quantity of water is unusually great, the pressure which it exerts upon the gland may be so severe as to lead to considerable flattening, softening, and more or less atrophy. In some instances, in fact, the tubular structure is nearly entirely absorbed.

Most hydroceles have a pyriform, conical, or globular shape; sometimes they exhibit a sort of hour-glass contraction, and occasionally, as before stated, the water is contained in distinct sacs. The disease is generally unattended by pain, except where the accumulation is large, when it is apt to incommode by its weight. The tumor is hard but compressible, and usually quite translucent when examined by candle-light in a dark room. The testicle lies almost always at the posterior part, opposite the inferior third of the swelling.

Hydrocele is commonly slow in its development, and often remains stationary for years. When caused by external violence, however, its progress may be so rapid as to entitle it to the appellation of an acute disease. It may occur as a simple, uncomplicated affection, or it may be associated with disease of the testicle or its envelopes, of the scrotum, the urethra, or urinary bladder.

Hydrocele makes its appearance at all periods of life, in infancy, in childhood, in adolescence, and in old age. Children sometimes labor under this

\* Lond. Med. Gaz., vol. xii., p. 764.

complaint, from the vaginal tunic continuing to communicate with the cavity of the abdomen, and allowing the water effused there to descend along the groin. This constitutes what is called *congenital hydrocele*.

In 1000 cases of hydrocele treated at the Native Hospital of Calcutta, the age in

41	cases was from	-	-	18 to 20
173	„	„	-	21 to 25
473	„	„	-	26 to 35
257	„	„	-	36 to 45
43	„	„	-	46 to 59
13	„	„	-	60 to 70*

In sixty cases examined by Velpeau,† the ages were as follows:—

3	between	-	-	-	15 and 20
13	„	-	-	-	20 „ 30
11	„	-	-	-	30 „ 40
16	„	-	-	-	40 „ 50
10	„	-	-	-	50 „ 60
6	„	-	-	-	60 „ 70
1	„	-	-	-	70 „ 80

Hydrocele is generally single, but may occur on both sides, either simultaneously, or successively. Of the 1000 cases examined by Dujat at Calcutta, the disease was double in 370, or in rather more than one-third. In 305 cases it was observed on the right side, and on the left in 325. Of fifty-four cases of this complaint observed by Curling, forty-nine were single, and five double. Of the former, twenty-seven occurred on the right side, and twenty-two on the left. Gerdy has reported thirty-six cases, in eighteen of which the disorder was noticed on the left side, in thirteen on the right, and in five on both sides. Of forty-three cases which occurred to Velpeau, the hydrocele was on the left side in thirty, and in nine on the right; in four cases the side is not indicated. These facts tend to show that the disease in question takes place with nearly equal frequency in both vaginal tunics.

*Hæmatocele*, as its name imports, is a collection of blood in the vaginal sac, caused by mechanical violence, or inflammatory irritation; in the latter case it is ordinarily connected with hydrocele. The tumor is pyriform, dark, compressible, and filled with thick, grumous blood, often of the color of coffee-grounds. The vaginal tunic is sometimes preternaturally hardened, and its inner surface roughened with lymph. This affection, which is seldom painful or attended with constitutional disturbance, may be distinguished from hydrocele by its dark color, its obscure fluctuation, its weight, and by the fact that it is usually the result of external injury. Sometimes the clots that are thus formed become organized, the vessels which they contain being susceptible of artificial injection.

*Encephaloid*, though occasionally found in the vaginal sac, is extremely rare. I have never met with it, and Sir Astley Cooper has seen it only once. The morbid mass has a white, brain-like aspect, and possesses all the characters of fungus hæmatodes. It is commonly connected with hydrocele and thickening of the serous tunic. No particular pain seems to attend the development of this disease.

Sometimes the vaginal tunic acquires a cartilaginous hardness; and portions

\* Gazette Médicale de Paris, t. xvi., 1838, p. 561.

† La Presse Médicale, Mai, 1837.

of it, as before stated, have been found in an ossified state. These transformations, which are not infrequent attendants on old hydroceles, ordinarily occur in small patches, of no determined shape; but sometimes they grow from the free surface of the membrane in the form of little spicules, the attachment of which is affected by very slender footstalks.

One hundred parts of ossific matter from the vaginal tunics, divested of membrane and dried, were found, by Mr. John T. Barry,\* of London, to consist of

Phosphate of lime	-	-	-	-	45
Carbonate of lime with a trace of magnesia					17
Animal matter	-	-	-	-	38
					<hr/>
					100

In dissecting persons that have labored for a long time under hydrocele, or other chronic affections of the serous covering of the testicle, we occasionally find small *earthy concretions*, either contained in distinct sacs, or floating about in the serum. Their number, though sometimes considerable, seldom exceeds two or three; their size varies from that of a shot to that of a pea; and not unfrequently they have a peculiar pearly lustre. Sometimes such bodies are partly osseous and partly cartilaginous; and now and then they are remarkably hard and gritty, like grains of sand. Their composition is carbonate and phosphate of lime, with about thirty-eight parts of animal matter in the hundred. The celebrated John Wesley, who was afflicted with hydrocele in his old age, is said to have had a small concretion of this kind drawn off by his physician.

II. The testicle is liable to inflammation, purulent deposits, scirrhus, encephaloid, tubercles, hydatids, and osseous degeneration.

The anatomical characters of *acute orchitis* are, increased vascularity, and thickening of the tubular structure, followed, when the disease runs high, by deep redness and softening. The organ swells, becoming hard and rounded, and the vaginal sac is either distended with watery fluid, or lymph is poured out, by which the two contiguous surfaces of the membrane are permanently glued together. The epididymis is usually involved in the affection, and in many cases the irritation extends along the spermatic cord, rendering it tumid and painful.

This disease, although it generally terminates by resolution, sometimes proceeds to suppuration, or it leaves the organ in a state of chronic enlargement, or, finally, it may give rise to hydrocele. The most common causes of acute orchitis are, local violence, suppression of the gonorrhœal discharge, mumps, stimulating injections, and vicissitudes of temperature. Great tenderness and swelling of the part, inflammatory fever, nausea, and vomiting, with irritability of the bladder, and dull, aching pain along the course of the spermatic cord, constitute the characteristic symptoms of the disease.

When suppuration is about to set in, all the symptoms become suddenly aggravated; rigors now come on, attended often with slight delirium; and the part is so painful that the patient can scarcely tolerate the weight of the bed-clothes. The pus, being generally mixed with seminal fluid, is seldom of a healthy character; and, as it is confined by the albugineous coat, it is always a long while in working its way to the surface. The abscess often breaks at several places, thus leaving unhealthy sores, which it is difficult to heal, and which not uncommonly lead to a total disorganization of the tubular struc-

\* Sir A. Cooper on the Diseases of the Testis, p. 245.



ture. Suppuration of the testicle is most common in scrofulous subjects. The matter is sometimes encysted, as in Fig. 208.

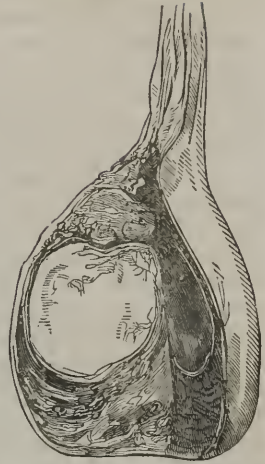
Chronic inflammation of the testicle is of rather frequent occurrence, especially in warm latitudes. It usually begins in a hardness and swelling of the epididymis, from whence it gradually extends to the body of the gland, the seminiferous ducts of which are dilated, indurated, and of a dark greyish color. At first, the organ, enlarged perhaps many times beyond its ordinary bulk, retains its natural smoothness, but by and by it becomes knobby and irregular. This form of the disease is often accompanied by effusion of serum into the vaginal sac, by the deposition of purulent matter in the parenchymatous structure, and by enlargement and thickening of the spermatic cord. In obstinate cases, the gland is sometimes of a hard, compact consistence, grates under the knife when cut, and is of a dark, reddish color, not unlike half-boiled flesh. Cells are often found in its interior, containing different kinds of fluids. The disease occasionally affects both testicles. There is seldom much constitutional derangement, and the organ is usually free from pain, manifesting little or no tenderness on pressure.

*Genuine scirrhus* of the testis, such as is so often met with in the mammary gland, is an exceedingly rare disease. It is most common after the age of fifty, and is often traceable to the direct effects of injury, syphilis, or gonorrhœa. The affected gland is hard and knobby, of a whitish or greyish color, and intersected by dense fibrous bands, which pervade it in different directions, and add very much to its firmness. It is seldom that the morbid mass is of the same uniform consistence throughout, but it is usually more compact in some places than in others. Cartilaginous and osseous deposits are not unfrequently observed in it, and instances occur in which it contains small cysts, filled with various kinds of substances, fluid, semi-liquid, or solid. The vaginal and albugineous tunics are more or less thickened, and the tubular texture of the organ is entirely destroyed. As the disease progresses the epididymis, and frequently, also, the lower portion of the spermatic cord experience the same changes, becoming hard, knotty, and painful.

Scirrhus of the testicle may be distinguished from other diseases by the tardiness of its progress, by the small size, excessive firmness, and tuberculated surface of the tumor, by the tenderness experienced on pressure, by the sharp, lancinating pain shooting along the spermatic cord to the loins, and by the adhesions which the gland forms with the scrotum. When ulceration sets in the countenance assumes the usual sallow aspect, and the adjoining glands become swollen, from the extension of the morbid action. The disease may exist alone, or be associated with scirrhus, tubercle, or encephaloid of some of the other parts of the body.

*Encephaloid* is the most common malignant disease to which the testicle is liable. Commencing in swelling and induration of the body of the gland, its progress, although sometimes slow, is generally so rapid that the tumor quickly attains a very considerable bulk, involving the epididymis, and assuming a pyriform figure, with the base below and the apex above. In its first stages it consists of a soft, greyish, pulpy mass, looking very much like the cerebral

Fig. 208



tissue. It frequently contains serous cysts, coagulated blood, chocolate-colored matter, or a dark creamy substance, more or less offensive to the smell. One portion of the tumor may be so firm as to creak under the knife, and to exhibit the appearance of fibro-cartilage, or hard cheese; another is perhaps quite soft and pulpy, and a third may be of the color and consistence of a clot of blood, or a piece of decomposed flesh. In fact, there is no end to the diversified character of a tumor of this description.

The tubular structure is generally entirely destroyed; the albugineous coat is very much thickened and indurated, or broken up and confounded with the diseased mass; and a considerable quantity of watery fluid, usually mixed with blood, is almost always found in the vaginal sac. During the progress of the disease the gland loses its smoothness and regularity, its surface becoming rough and knobby; the swelling is soft, doughy, and irritable; the spermatic cord enlarges, its vessels being often hard and varicose; the inguinal ganglions of the affected side are tumid and tender; the patient complains of occasional pain in the tumor, darting into the groin and lumbar region; the subcutaneous veins are enormously increased in volume; the countenance is wan and sallow; and all the phenomena, both local and general, indicate the destructive tendency of the malady. Towards the close ulceration occurs, attended by a discharge of bloody serum, and by the development of fungous granulations, remarkably sensitive, of unusual size, and so tender as to bleed on the slightest touch. At this stage of the disease the lymphatic glands of the pelvis and abdomen are often greatly enlarged, and the patient is wasted to a skeleton by his excessive sufferings.

Encephaloid of the testicle may be distinguished from hard cancer and other diseases by the following circumstances: First, by its growth, which is always more rapid than that of scirrhous, colloid, or cystic sarcoma; secondly, by the pyriform shape and large bulk of the tumor; thirdly, by its soft and elastic feel; fourthly, by the nature of the pain, which is less constant and severe in encephaloid than in scirrhous; fifthly, by the extraordinary enlargement of the lymphatic ganglions of the groin; and sixthly, by the varicose state of the subcutaneous vessels. In hydrocele the tumor is transparent and has a distinct fluctuation; there is no pain, or disease of the spermatic cord, and the general health is unimpaired.

The tumor varies in volume from that of a fist to that of a fœtal head. In a case mentioned by Mons. Boyer,\* of Paris, it weighed upwards of nine pounds. This, however, is far from common. When the tumor is very bulky there is always a corresponding enlargement of the vessels of the cord. Curling states that he has seen the spermatic artery in a case of encephaloid of the testicle as big as the radial artery at the wrist.

It is said by Sir Astley Cooper that encephaloid always commences in the body of the testis. This, however, is true only as a general rule, for it appears from the researches of Dr. Baring,† that the primary seat of the affection is occasionally in the epididymis.

No period of life is exempt from this disease. It has been observed in children under twelve months of age; and, on the other hand, it has occasionally been noticed in very old subjects. The affection seldom occurs on both sides. When the morbid mass is removed, the disease generally reappears either at the cicatrice, or in the lymphatic ganglions of the groin, pelvis, or lumbar region.

\* *Revue Médicale*, Nov. 1839.

† *Treatise on the Medullary Fungus of the Testicle*, *Brit. and Foreign Rev.*, vol. i., p. 472.

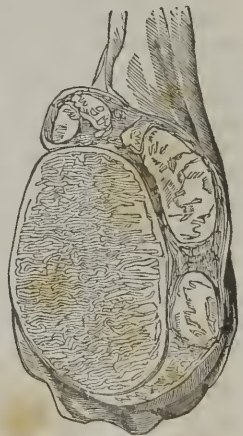
*Colloid cancer* scarcely ever attacks the testicle. The only cases, in fact, of which I have any knowledge are those mentioned by Cruveilhier\* and Curling.† In the former, which coexisted with encephaloid of the ribs and vertebræ, the testicle was four inches and three-quarters in length by two inches and three-quarters in breadth, but its form and consistence remained unaltered. A section of the morbid mass exhibited an immense number of very small cells, cysts, or lodges, composed of fibrous walls, and occupied by different substances. Of these the most remarkable was a pearly, coherent matter, easily enucleated, of a rounded figure, and of a shining appearance. Some of the cysts contained serosity; some a greyish, dense, semi-transparent substance, of a cartilaginous aspect; and a great number were filled with concrete puriform matter, between pus and tubercular. Many of the cells communicated with each other by small apertures, but the rest were completely isolated or shut. The proper substance of the testicle did not participate in the disease, but was rolled up into a thin, greyish, semi-transparent layer at the surface of the tumor. The patient was twenty-seven years of age. In the case mentioned by Curling, the organ was also enlarged to four or five times its natural size, and preserved its oval form; but there was scarcely any vestige of the glandular structure. The age of the subject is not stated.

Of melanosis of the testicle our knowledge is exceedingly limited. I have not myself met with any examples of the kind, and very few have been reported by authors. Cruveilhier‡ has related the case of a man who died at the age of forty-six of melanosis of the lungs, heart, stomach, and other parts. The right testicle contained a small quantity of the same matter, and the left a deposit the size of a nut. Neither Cooper, Curling, Mercier, nor Moulinic have met with this disease.

*Tubercles* are sometimes seen in the testicle, occurring either in its interior, on its surface, or in the epididymis: they are commonly of a pale yellowish color, spherical, and about the size of a pea. Occasionally the scrofulous matter is infiltrated in the tubular structure; and in this manner the whole gland may be converted into a curdy, friable, cheese-like substance. The disease which begins without local uneasiness is liable to end in ulceration; a very unpleasant sore may be thus created, which is of a pink color, fungous, irregular on the surface, and often highly sensitive. The deposition seldom takes place in both glands at the same time: it generally begins at the epididymis of one of them, and extends from thence to the body of the organ, which it sometimes entirely subverts. The matter is usually poured into the cellular element; but, in some cases, there is reason to believe that it is deposited directly into the excretory tubes. A good specimen of this matter in the epididymis is represented in Fig. 209.

*Cystic disease* of the testicle, cystic sarcoma, or hydatid disease, as it has been improperly named by Sir Astley Cooper, by whom it was first described, is occasionally met with,

Fig. 209.



\* Anatomie Pathologique, livr. v., p. i.

† Practical Treatise on the Diseases of the Testis, p. 385, Phil. 1813.

‡ Anatomie Pathologique, livr. xix., pl. 3 and 4.



Fig. 210.



and sizes, with solid matter interposed between them. The natural structure of the gland has entirely disappeared.

The progress of this disease, which always begins in the body of the testicle, is usually slow. It commences in the form of an indolent swelling, which is seldom attended with pain, and which may continue, without seriously impairing the general health, until it has acquired a bulk equal to that of a large fist or even a fetal head. The tumor is of an oval shape, opaque, heavy, and less fluctuating than hydrocele, from which it is not always easy to distinguish it. The epididymis, which commonly retains its healthy structure for a considerable period, is gradually confounded with the rest of the swelling. How this affection originates has not been ascertained. It has been supposed to consist in a morbid dilatation of the seminiferous tubes, but we are not in possession of any facts which warrant such a conclusion.

It is very seldom indeed that the testicle contains *hydatids*. Curling states that he has never, in the examination of a large number of testes, met with a single example. Baillie and Cruveilhier make no mention of it. Dupuytren and Larrey have each recorded two cases. Sir Astley Cooper\* relates an instance of a hydatid, probably an *acephalocyst*, which was contained in a bag connected with the epididymis. It was of a pearly appearance, perfectly detached from its envelope, and filled with watery fluid. The testicle was nearly twice the natural volume. Dupuytren† has observed the disease in several members of the same family.

Baillie‡ met with a *filaria medinensis*, or guinea-worm, in a small, firm cyst,

chiefly about the middle period of life. The cysts of which it is composed vary in size from that of a mustard-seed to the dimensions of a small grape, a marble, or a pigeon's egg; they are extremely delicate, highly vascular, gregarious, and contain a thin, transparent, straw-colored fluid, analogous to the serum of the blood. They are developed in the substance of the testicle, which is ultimately entirely destroyed, and they often exist in immense numbers, though in some cases there are not more than two, three, four, or, perhaps, half a dozen. Occasionally the coats of these cysts are very much indurated, if not partially transformed into cartilage or bone, and their contents are thick and glairy, like the white of egg, jelly, or inspissated mucus. In old cases large quantities of fibrin are sometimes effused, and the morbid mass is intersected by fibrous bands, which strikingly contrasts with the other structures. Fig. 210, from Curling, is a section of a cystic tumor of the testicle, showing a multitude of cells of various shapes

\* Observations on the Structure and Diseases of the Testes, p. 90.

† Vidal, Traité de Pathologie Externe, t. v., p. 704 : Paris, 1841.

‡ Works by Wardrop, vol. ii., p. 313. London, 1825.

adherent to the testicle. Paullini\* saw a man whose left testicle contained an abscess, from which not less than fifty-seven small worms escaped. Morgagni found a small mass of fat between this organ, which was in other respects sound, and the epididymis.

Masses of fibro-cartilage are occasionally, though rarely, found in the testicle, either alone, or, as is more commonly the case, in union with other morbid products. They may be situated between the vaginal and albugineous coats, or in the tubular substance of the organ, which, when they are large or numerous, may be in great measure destroyed by them. They are usually small in size, and of an irregularly oval shape, with a rough, uneven surface, elastic, homogeneous, and of the consistence of fibro-cartilage. Sometimes they are partially ossified. When seated in the albugineous coat, or between this membrane and the vaginal, the new matter generally presents itself in the form of little patches, frequently not more than a few lines in diameter, and of a dull greyish color. Wagner† has described a testis which was completely transformed into *cartilage*.

*Ossification* of the glandular structure of this organ is of very infrequent occurrence. Examples, nevertheless, are recorded by a considerable number of writers. The deposit may take place in any part of the testis, but is most common towards its centre, and is generally accompanied with considerable enlargement. In the case of a young man of seventeen, mentioned by Dubois, each testicle weighed upwards of one pound. The deposit is often of an earthy rather than a bony nature, being nearly destitute of animal matter, and closely resembling the earthy substance found in the lungs and bronchial glands.

The testicle has been found, in a few cases, transformed into a fibrous substance, not unlike that of a fibrous tumor of the uterus. The change probably begins in the internal cellular structure, which is gradually converted into white, greyish, or bluish filaments, narrow, dense, resisting, and interlaced in every conceivable manner. The new tissue interferes so much with the nutritive condition of the seminiferous tubes as to occasion, at first, a diminution in their size, and ultimately their entire destruction. When the transformation is completed the morbid structure is firm, solid, almost incompressible, and inelastic; it creaks under the knife, possesses very little moisture, and is nearly destitute of cellular substance. Small cysts, containing serous fluid, are occasionally interspersed through it, and specimens have been observed in which there were tolerably large cavities filled with whitish, jelly-like matter. The tumor may be of the natural size of the testicle, or it may even be less, but in most instances it is as large as an orange or a fist. It is generally of an oblong, rounded shape, remarkably heavy for its bulk, and perfectly smooth on the surface. The vaginal and albugineous tunics generally preserve their natural characters. The disease is altogether of a local nature, and has no tendency to return after removal. Its progress is slow, and unattended with pain.

Tumors of the kind just described occasionally grow within the vaginal tunic, the testis retaining its integrity. Four years ago I operated upon a colored man, twenty-five years of age, a patient of Dr. Talbot and Dr. Wakefield, of this city, and removed from the left side a fibrous mass weighing nearly five pounds. It was of an ovoidal form, larger below than above, and was eight inches and a quarter in length by thirteen in circumference at its widest part. Its surface was perfectly smooth, and adherent, in the greater

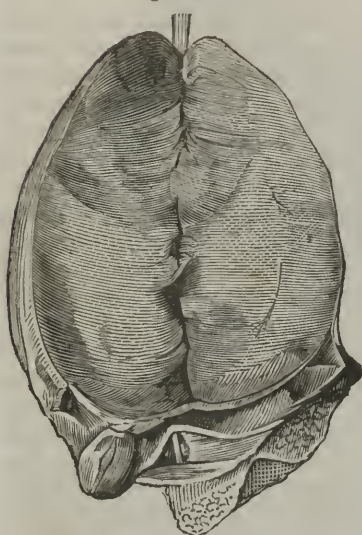
\* Miscel. Natur. Cur. Dec. ii., An. iv., append., ob. 39.

† Halleri Coll. Disp. Chirur., t. v., p. 558.



portion of its extent, to the vaginal tunic by loose cellular substance. The testicle was situated at the lower extremity of the tumor, and with the exception of being slightly flattened, had undergone no appreciable alteration. The vas deferens, also perfectly sound, ran along the posterior surface of the tumor.

Fig. 211.



A section of the tumor exhibited a smooth, uniform surface, of a pale-greyish color. It was slightly elastic, almost incompressible, remarkably solid, and offered great resistance to the knife. A thin slice of it was opaque, and as tough as sole-leather. No cellular tissue could be detected among its component fibres, but here and there I could distinctly discern the orifice of a divided vessel. The tumor had been growing upwards of five years,—during the last eighteen months very rapidly,—and caused no other inconvenience than what resulted from its weight and bulk. The spermatic cord, the skin of the scrotum, and the glands of the groin were perfectly healthy. The patient recovered from the operation, but died some months afterwards of pulmonary phthisis.

Fig. 211 exhibits the form and structure of the tumor; the testicle is seen at the base, to the left of the median line.

*Hypertrophy* of the testicle, without any appreciable change of structure, is a very uncommon circumstance. Baron Larrey has witnessed some cases of it, and several have been recently reported by other writers. The gland may attain the magnitude of a large fist. The general health is usually good; but the penis is incapable of erection, and the tumor incommodes by its weight. More commonly the hypertrophy is connected with induration, and various other deviations from the normal state.

*Atrophy* of this organ seems to arise from chronic irritation, leading to absorption of the tubular structure. It may result, however, from a great variety of causes, such as an abuse of venery, indulgence in masturbation, mechanical injury, obliteration of the spermatic arteries, and immoderate and long-continued use of iodine, opium, and other narcotics. In some instances it has been known to supervene upon injury or organic disease of the cerebellum; and, in the French soldiers, in Buonaparte's first campaign in Egypt, it was often produced, as was supposed by Larrey, by the employment of a species of brandy, manufactured from the date and laurel-berry. The wasting was generally very gradual, commencing with a loss of sensibility of the organ, which became softened, and at length reduced to the size of a small bean. Contemporaneously with this structural lesion was an altered state of the voice, with cessation of the growth of the beard, and complete loss of sexual powers.

Another very frequent cause of this lesion is mechanical pressure exerted upon the testicle by varicose tumors of the spermatic veins. Of this, several cases have come under my own observation, and others have been communicated to me by my medical friends. The absorption which is thus induced often proceeds with great rapidity, until the gland is reduced to a soft, pulpy mass, scarcely equal in volume to a Lima bean.

Atrophy of the testicles occasionally exists as a congenital defect. I am



acquainted with two young men, natives of the State of Ohio, in whom these organs are scarcely as large as a hazelnut. One of them has never experienced the slightest sexual desire; the other has been married upwards of eight years, but no offspring has followed the connection. Complete inaction, such as is observed in monks, is often attended with atrophy and impotence.

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## SECTION II.

### OF THE SPERMATIC CORD.

The spermatic cord, composed of the deferential duct, of blood-vessels, nerves, and absorbents, all invested by a thin, fibrous sheath, is liable to encysted hydrocele, varicocele, and neuralgia.

*Encysted hydrocele* may be seated in the free portion of the cord, or it may occupy the part which lies in the inguinal canal. In the former situation, the nature of the swelling may be readily distinguished by its globular figure, by its firmness, transparency, and diminutive size; in the latter, the diagnosis is often obscure, and the surgeon is liable to confound the disease with inguinal hernia. The fluid of a hydrocele of this kind is generally very thin and limpid, and the cyst consists of two layers, the external being formed by the spermatic fascia, the internal, which is almost always thickened, by the remains of the peritonæum. Let us be understood on this subject. In the descent of the testicle, the cord is loosely invested by a prolongation of the serous membrane of the abdomen; this, after a time, contracts close adhesions around the cord, and in this way the communication between the peritonæum and the testicle is gradually destroyed. Occasionally, however, it happens that the union is in some places incomplete, and, a space being thus left, a slight secretion goes on, and an encysted hydrocele, as such an accumulation is called, is the consequence. The tumor is commonly small, rarely exceeding the volume of a pullet's egg.

*Varicocele* consists in an enlargement of the spermatic veins, as they stretch from the testicle where they originate, to the groin. In several cases in which I have examined the condition of these vessels after death, I have found them greatly convoluted, knotty, elongated, harder in some places than in others, and irregularly dilated, some of them being more than six times the ordinary volume. Their parietes were very thick, dense, and rigid, almost of the nature of fibro-cartilage at some points, and very brittle and attenuated at others. In cases of long standing, some of the vessels are completely obliterated by adhesive inflammation, or by the formation of fibrinous concretions in their interior. Phlebolites are also occasionally found in them. The connecting cellular tissue does not seem to experience any particular alteration, but the veins of the testicle itself are often considerably enlarged, as are also those which ramify between the vaginal and albuginous coats.

The tumor resulting from this varicose condition of the veins is of a conical or elongated globular shape, irregular, compressible, and feels like a bundle of cords, a cluster of earth-worms, or a mass of the intestines of a rat. It occurs much oftener on the left side than on the right, and is seldom attended with much pain or suffering. Pathologists have endeavoured to assign a reason for the greater frequency of this affection on the left side than on the right, by supposing that it is connected with the more dependent situation of the left

testicle, and the greater length of the left spermatic vein, which, instead of ending in the inferior cava, like the right, terminates in the left renal, nearly at a right angle with the stream of blood from the kidney. This explanation, suggested originally, I believe, by Morgagni, is certainly plausible, and perhaps sufficiently near the truth. Be the cause, however, what it may, the fact is undeniable that the disease is generally found on the left side. In upwards of one hundred cases examined by Breschet, only one occurred on the right side.

Varicocele is most common in young subjects, within the first ten years from the time of puberty. Of forty-five cases mentioned by Landouzy,\* a recent French writer, thirteen occurred between the ages of nine and fifteen, twenty-nine between fifteen and twenty-five, and three between twenty-five and thirty-five. With this result the experience of every practitioner must coincide.

Varicocele appears to be occasionally hereditary. Professor Blandin, in an interesting article on this disease, in the "Dictionnaire de Médecine et Chirurgie Pratiques," refers to three brothers who were all exempted from military duty on account of the existence of this disorder: the father was similarly affected. An analogous case is mentioned in an inaugural thesis, published at Paris in 1837.

The progress of this affection is usually slow. One of the most unpleasant effects to which it gives rise is atrophy of the testicle and epididymis, produced by the pressure of the enlarged and distended veins. Occasionally, though rarely, the disease exists on both sides.

*Neuralgia* sometimes occurs in the spermatic cord, extending to the epididymis and body of the testicle. The affection, seated probably in the nervous plexus around the spermatic vessels, is of the nature of *tic douloureux*, being characterized by unnatural sensibility of the affected parts, with excessive tenderness on pressure, and pain in the groins, sometimes darting into the back and thighs. The testicle is but little swelled; the cord is not perceptibly altered; and, if the parts composing it be removed from the body, and carefully inspected, no lesion whatever is to be observed in them, excepting, in some rare cases, a slight thickening of the nerves.

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### SECTION III.

#### OF THE SEMINAL VESICLES.

Little is known respecting the lesions of the seminal vesicles. That they are liable to derangement, is sufficiently obvious; but that their diseases are few and of rare occurrence, is equally certain. Hitherto, these reservoirs have been almost entirely overlooked in our examinations; and to this omission, perhaps, more than to any thing else, is to be ascribed the meagreness of our information. Their average length is about two inches and a half, their breadth six lines, and their thickness four lines.

*Inflammation* of the seminal vesicles rarely exists as a primary disease; most generally it is propagated to them from the urethra, bladder, prostate gland, or testicles. In a few instances, pus has been detected in them; and, on one occasion, I found the left in a fetid, gangrenous condition. The individual

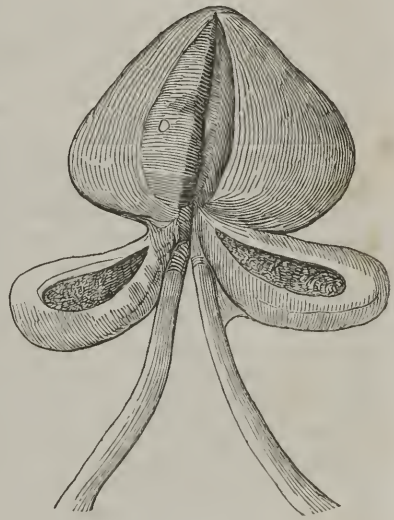
\* *Essai sur la Varicocèle, Journal des Connaissances Médico-chirurgicale, Jan. et Mars. 1838.*

was fifty-eight years of age, and died of inflammation of the prostate, accompanied with complete retention of urine for nearly a week. The right vesicle was of a dark color, from the loaded state of its vessels; and its cavity was filled with a thick, muco-purulent fluid, mixed with a small quantity of semen.

Collections of purulent matter in these reservoirs do not appear to be so uncommon as is generally supposed. Well authenticated cases of the kind are mentioned by Stoll, Albers, Cruveilhier, Dalmas, Mercier, Lallemand, and other writers. The disease is usually, if not invariably, associated with, or, most probably, dependent upon, inflammation of the prostate gland, the testicle, or the urinary bladder. Occasionally all these organs are involved at the same time, and the inflammation may even affect the ureters and kidneys. The pus may discharge itself along the ejaculatory ducts, or it may make its way, by ulcerative absorption, into the urinary bladder or rectum, as in the cases observed by Andral and Martin. It is not improbable that it sometimes escapes through a fistulous opening in the groin.

Tubercular matter is much more rarely deposited in the seminal vesicles than in the testicles, uterus, or Fallopian tubes; and thus far I have witnessed only one example of it. The individual was twenty-seven years of age, for the last four or five of which he had laboured under lumbar abscess, of which he finally died. Both reservoirs were remarkably pale, of a fibro-cartilaginous texture, and reduced to less than one-half their natural size. Their sacculated arrangement had disappeared, and their cavities were distended with yellowish tubercular matter, of a semi-concrete consistence. (Fig. 212.) Baillie saw a case in which one of the seminal vesicles was completely filled with a similar substance: and Andral met with tubercles both in these reservoirs and in the testicles. In a subject whose history could not be ascertained, Cruveilhier found the seminal vesicles transformed into small pouches full of tubercular matter; similar deposits existed in the ejaculatory canals, the prostate gland, and one of the deferential ducts together with the corresponding testicle. In a man sixty-two years old, whose prostate gland was destroyed by ulceration, Mr. Howship\* observed the left seminal vesicle filled with a pale yellow, cheesy substance, its coats being exceedingly thickened, and as firm as a gizzard. The corresponding deferential duct was enlarged near its termination, and loaded with a similar substance.

Fig. 212.



Small earthy concretions, of the same nature as those of the prostate, have been found in these reservoirs. Their form is usually rounded, their surface smooth, and their color pale-greyish, white, or yellowish; their number varies from one to a dozen. In a singular case mentioned by Mitchell,† more than two hundred were contained in the right seminal vesicle. The patient died of pulmonary phthisis, and the presence of the foreign bodies had not even been

\* Treatise on the Urinary Organs, p. 362.

† Civitàle, *Traité sur les Maladies des Organes Genito-Uriinaires*, t. ii., p. 135.



suspected during life. Other, but less remarkable instances are recorded by Valentin, Stalpaart Van der Wyl, Garnann, Riedlin, Hartmann, Meckel, and Hemmann.\*

The seminal vesicles have been observed to be very much indurated, and more or less changed in their structure. The most common transformations are the fibrous and fibro-cartilaginous. Occasionally their walls are of a dense, gristly nature, and in a case mentioned by Sæmmering, they were partially ossified. Lallemand observed an instance in which both these pouches were converted into bony shells.

None of these changes here described seem to have any particular signs that mark their existence during life. In the case above mentioned, in which one of these organs was gangrenous, there was violent pain in the region of the prostate gland, with retention of urine, and, towards the close of the illness, the most furious delirium; but no symptom whatever that could be referred to the seminal vesicle.

The seminal vesicles are sometimes remarkably small, and occasionally one of them is absent. In some instances their ducts are wanting, and in others they are obliterated by inflammation, lymph, or tubercular matter, of which I have seen several examples. Professor Blandin mentions† a case, which he observed in the body of a mendicant, where both the excretory tubes terminated in a sort of flexuous cul-de-sac, which supplied the place of the seminal vesicle.

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## SECTION IV.

### OF THE SCROTUM.

The scrotum is liable to be affected with inflammation, cancer, and other diseases. Of these, it is only necessary to notice a few of the more important.

*Cancer* of the scrotum seldom occurs before the period of puberty. It is most common in scrofulous persons, and chimney-sweepers; and hence it has by some been named the chimney-sweeper's cancer. The affection generally begins at the base of the scrotum, in the form of a small, wart-like excrescence, covered by a thin, scaly crust. After this has continued for a time, the hardened cuticle sloughs off, leaving a superficial, painful, ill-looking ulcer, with indurated and everted edges. The surface of the sore has a red, excoriated aspect, and discharges a thin, sanguinolent fluid, often highly irritating and offensive. In this way, the ulcerative process gradually extends, until at length a large surface of the scrotum, together with the vaginal tunic and the exterior of the testicle, is involved in the disease. In this advanced stage, the cellular tissue around the sore is generally white and scirrhous; and the inguinal glands on one or both sides are enlarged, injected, and, in some instances, filled with scrofulous matter. At the commencement of the disease, the part is merely affected with troublesome itching; but, after a while, the patient complains of darting pains, which often extend along the spermatic cord, and the scrotum is hot and tender on pressure.

The scrotum is sometimes transformed into a hard, fleshy mass, constituting what is termed *sarcomatous* enlargement. The enormous magnitude which

\* Voigtel, Handbuch der Path. Anatomie, B. 3, S. 415.

† See his "Nouveaux élémens d'Anatomie Descriptive," t. ii., p. 264. Paris, 1838.

this disease may attain is almost incredible. A surgeon of the West Indies removed a tumor of this kind from the scrotum of a negro, which weighed seventy pounds; and Baron Larrey has detailed the particulars of another, which was supposed to weigh one hundred and twenty pounds. In the medical museum, at Montpellier, is a diseased mass of this character, which was amputated by the learned Delpech, the weight of which, I am told, is one hundred and sixty pounds.

This disease is seldom observed in this country or in Europe; but in some parts of Asia and Africa it is not of infrequent occurrence, especially in persons afflicted with elephantiasis. Externally, the morbid growth is rough and fissured, and its surface, particularly in old cases, is covered with yellowish, scaly crusts, the detachment of which leaves so many small, herpetic sores, emitting a thin, ichorous discharge. The skin is very thick and indurated; the cellular tissue is firm and scirrhus, from the distention of its cavities with semi-concrete, albuminous matter; and the blood-vessels of the part, instead of being large and varicose, as we find them in most other tumors, are remarkably small and contracted. The swelling is commonly indolent, and incommodes rather by its weight and bulk than by its pain. In its shape it is mostly pyriform, but sometimes ovoidal, or globular. The testicle is not necessarily implicated in this disease, nor is the spermatic cord so much indurated and enlarged, as in some of the other disorders of the genital apparatus.

A peculiar *sloughing* disease occasionally occurs in the scrotum of young children. In a case which I recently saw with Dr. Woodward, in an infant two weeks old, a slough, about an inch in diameter, suddenly formed over the right testicle, leaving the vaginal tunic perfectly denuded, and producing an angry-looking sore with hard glossy edges, reposing upon black-colored cellular tissue. The spermatic cord was indurated, tumid, and remarkably tender on pressure. The constitution did not seem to suffer much. In the course of twenty-four hours after these symptoms were discovered, the vaginal sac became distended; and, on puncturing it, a considerable quantity of sero-purulent fluid, of a yellowish color, followed the lancet. A small portion of the membrane now sloughed, leaving the gland quite bare; by touching the part with lunar caustic, and applying the yeast poultice, granulations gradually sprouted up, and the infant got well.

We sometimes find cysts in the scrotum filled with fatty matter, teeth, hair, or osseous fragments, or all these substances in a state of combination. In a case of this description, observed by St. Donat, a French surgeon, the tumor contained, amongst other pieces, two distinct frontal bones, the orbits of which were regularly hollowed out for the reception of two small, rudimentary eyes. In another example, the particulars of which have been published by Dr. Dietrich, Professor of Midwifery in the University of Glogau, the débris which was found in the testicle was composed of a pelvis and a lower extremity. A still more extraordinary instance was observed by Dr. Ekl.\* In this case, the scrotal tumor was formed by the ribs, the spinal column, the orbits, and thigh-bones of a fœtus. We have already alluded, in another section, to the singular case reported by Dr. André, of Pétronne, in which he discovered hair and teeth in the testicle of a boy, seven years of age.

But the most remarkable formation of this description is that mentioned by Velpeau,† and which this distinguished surgeon removed, in 1840, from a patient, twenty-one years old, in the Charity Hospital of Paris. The tumor,

\* See the interesting treatise of Dr. Ollivier, of Angers, entitled "Mémoire sur la monstrosité par Inclusion," in which this and other cases are detailed.

† New Jour. Med. and Surg., July, 1840, p. 202.

which had existed from birth, was of a rounded shape, of the size of a large turkey's egg, of a white color, insensible, and situated on the outer part of the right side of the scrotum ; the corresponding testicle, epididymis, and cord being perfectly sound. At its posterior surface were three small openings through which fatty matter was occasionally discharged. A careful dissection showed the tumor to consist of two portions, one of which was solid, of a rosy tint, and made up of numerous pieces of bone, while the other, of a softer consistence, presented several cysts of different sizes and of variable contents. The largest cavity was occupied by a greyish fatty substance, composed of distinct portions connected by jelly-like matter ; the one next in size contained a similar substance, only of a darker hue, and having in its centre a quantity of very fine hair ; the remainder were filled with a yellowish, stringy fluid, not unlike the vitreous humor of the eye. The solid part of the tumor was composed of different bones, variously arranged, articulated with each other, and surrounded by masses of fat ; the whole being evidently the remains of a fœtal skeleton.

The above, and all similar formations, which, on the whole, are extremely rare, bear the closest analogy to those of the ovary, and they can only be accounted for on the theory of monstrosity by inclusion.

There is another affection of the scrotum, which, although of very infrequent occurrence, may be briefly noticed in concluding this article. I allude to the deposition of earthy matter. This may take place in the form, either of sand-like granules, or in that of calculous masses, from the volume of a pea up to that of an almond. Their number, although generally small, sometimes amounts to several dozens ; they are of a dull whitish color, and of a cretaceous consistence, or even of the density and solidity of bone. Their chemical composition has not been ascertained ; but, judging from what we know in reference to these bodies in other situations, it is not improbable that they consist mainly of phosphate and carbonate of lime, cemented together by a small quantity of animal matter.

Hitherto these concretions have been found exclusively in subjects past the middle period of life, in association with hypertrophy. Their formation is generally very tardy, and the irritation which they produce sometimes leads to ulceration. In the interesting case observed by my friend, Professor Mott,\* of New York, the scrotum was nearly fifteen times the normal bulk, the patient was very far advanced in life, and the disease, which was removed by a surgical operation, had existed for upwards of twenty years.

In the fifth volume of the *Medical Observations and Inquiries* of London, Mr. Else, Surgeon to St. Thomas Hospital, has recorded the particulars of a case of encysted tumor of the scrotum which communicated with the urethra, and contained ninety-three calculous concretions. The largest, which was nearly round, weighed twenty-six grains ; the smallest a grain and a half ; they all had smooth surfaces, and the bag in which they were contained was very rough internally and a quarter of an inch in thickness. The patient was between twelve and thirteen years of age, and the disease, which had existed from his infancy, came on without any assignable cause.

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## SECTION V.

### OF THE PENIS.

The penis consists of several parts, differing from each other in their struc-

\* Philadelphia Jour. of the Med. and Phys. Sciences, vol. v., p. 335, N. S. 127.



ture and functions, and liable therefore to dissimilar lesions. The cavernous bodies, as they are termed, are rarely affected, whereas the urethra and the spongy texture around it are extremely liable to disease. Of the lesions of these different component elements, I shall notice only the more important, and I shall commence with those of the excretory duct.

*Acute inflammation* of the urethra, generally the result of impure connection, is marked by the same anatomical characters as acute inflammation of the mucous textures generally; that is to say, there is more or less redness, with opacity, and thickening of the lining membrane. In three or four days after the infection, sometimes not under a week or even a fortnight, there is an increased discharge of mucus, followed in a short time by purulent matter, of a thick ropy consistence, and of a pale straw color. The quantity evacuated in the twenty-four hours varies from one to several drachms, and, in violent cases, it is not unfrequently extremely acrimonious, of a greenish cast, or tinged with blood. The morbid action is usually limited to the extremity of the urethra, occupying the first two or three inches, — probably from this portion being most abundantly supplied with mucous follicles, and from the poison expending its virulence principally in this situation. Now and then, however, the disease pervades the entire tube, from one end to the other.

The *symptoms* of acute urethritis consist in a peculiar scalding sensation in voiding the urine, the calls to which are much more frequent than usual, and in a general turgescence of the virile organ, with redness and swelling of the external orifice, the edges of which are often tender and excoriated from neglect of ablution. The pain is always increased during erection, and the discharges of urine, which commonly flows in a small narrow stream, from the diminished caliber of the tube, caused by the turgid state of the lining membrane and the infiltration of the surrounding structures, especially the submucous. When the inflammation is violent it is apt to extend to the neck of the bladder, the testicle, and spongy body of the penis, giving rise to effusion of lymph and the formation of abscesses. In ordinary cases, however, there is seldom if ever any breach of continuity.

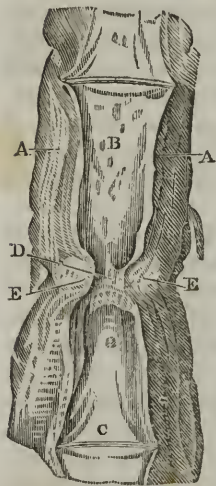
When the disease assumes the *chronic* form, the discharge becomes more thin and limpid, bearing a greater resemblance to the white of egg than to real purulent matter. The quantity, also, is much less than in acute urethritis, and there is seldom much pain, scalding, or itching during micturition. The passage, however, usually remains somewhat contracted, from relaxation of the mucous lining, and the urine, in consequence, is always discharged in a narrow, tortuous stream. When the disease, now called *gleet*, is protracted, it often gives rise to stricture, by which the canal is permanently obstructed.

A very frequent effect of gonorrhœa is the extension of the inflammation to the spongy structure of the penis, and the consequent effusion of lymph into its cells. This complaint, constituting what surgeons are in the habit of calling *chordee*, is characterized by abnormal erections, which are always most distressing during night, when the patient becomes warm in bed. The organ is curved downwards, from the spongy structure not admitting of so complete distention as the cavernous: and sometimes the cells are permanently obliterated, causing deformity of the penis, and imperfect erections. The effusion generally takes place about the middle of the organ, occupying occasionally a large extent of surface. In some cases, the deposition is affected at several points, though this is unusual.

Organic *stricture* of the urethra (Fig. 213) is the result of inflammatory action, causing an effusion of lymph into the submucous cellular tissue and upon the free surface of the lining membrane. After some time, varying

from a few days to several weeks, the effused fluid becomes organized, and thus forms a permanent obstruction, in front of which the passage is generally contracted, whilst behind it is dilated. The urethra is sometimes narrowed by a circular ring, not thicker than a thread, but more commonly the stricture occupies a considerable extent of surface, from a line or two to an inch or more. (Fig. 214.) Nor does it always surround the whole tube; in many cases, perhaps in most, it forms merely a segment of a circle. The bridge stricture (Fig. 215), as it is called, consists of a dense band of organized

Fig. 213.



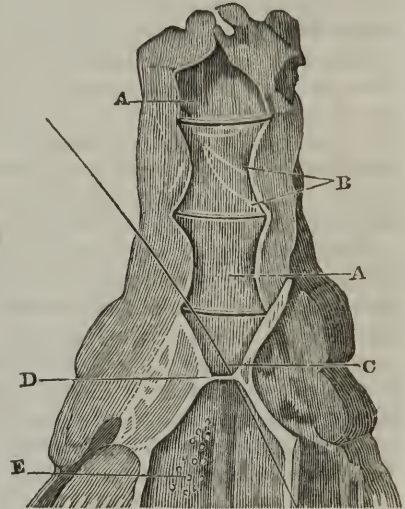
a a, corpus spongiosum;  
b c, urethra; d, stricture;  
e, indurated ring beneath  
the mucous membrane.

Fig. 214.



a d, urethra; b e, stricture.

Fig. 215.



a a, urethra; b c, mucous membrane; d, stricture;  
e, orifices of seminal ducts.

lymph, stretched from one side of the urethra to the other. In old cases, the contracted part, from repeated attacks of inflammation, is sometimes very elastic, firm, and almost of the consistence of fibro-cartilage. The most common seat of the disease is at the membranous portion, about seven inches from the external orifice; the one next in point of frequency is at the junction of the posterior with the anterior two-thirds of the tube; and, lastly, at the part immediately behind the neck of the penis.

Organic stricture is generally attended with pain in the loins, chronic swelling of the testicle, irritability of the bladder, itching about the anus and perinæum, and discharge of thin, gleet matter from the urethra. The stream of urine is small, forked, spiral, or dribbling, the bladder is emptied with difficulty, and micturition is usually accompanied with pain.

Besides the lesion now described, some writers believe in the existence of a temporary stricture, caused by *spasmodic* action of the urethra. The circumstances which are supposed to afford evidence of spasmodic stricture, are, according to Mr. Syme, the sudden invasion and disappearance of the complaint,



its connection with mental agitation, and the difficulty which the surgeon experiences in introducing the catheter. Some anatomists have imagined that this disease is caused by the contraction of the muscular fibres, which enter, as they allege, into the composition of the urethra; but as no such fibres have ever been satisfactorily demonstrated, the most plausible idea, it seems to me, is that which ascribes it to the turgescence of the lining membrane, or to the erectile texture which immediately invests its outer surface; and this opinion is strongly corroborated by the fact that the disorder in question is almost entirely confined to persons of an irritable, nervous temperament.

A very distressing consequence of stricture is *abscess*, followed by fistula in the perinæum, the rectum, or along the course of the urethra. The canal, as was before stated, is generally very much dilated behind the constricted part, forming a sort of pouch for the lodgment of the urine. Occasionally calculi are retained here, and give rise to very disagreeable symptoms. The suppuration is often very slow in its progress, and as the matter accumulates in the submucous texture, the lining membrane of the canal yields at one or more points, followed by the escape of the contents of the bladder into the surrounding cellular substance, where they always produce considerable sloughing. Extensive infiltration is sometimes prevented by the cellular tissue immediately around the abscess being so much condensed by the deposition of fibrin, as to present an effectual barrier to the diffusion of the fluid. The fistulous openings thus formed gradually diminish in size, and become incrustated by a layer of lymph, which, in cases of long standing, sometimes degenerates into fibro-cartilage. The passage in front of the perforation being no longer needed for conveying urine, now contracts, and, unless there be means used to dilate it, it is finally entirely obliterated. The number of these apertures is often considerable, the perinæum being literally burrowed by them.

*Malformations* of the urethra are far from being uncommon, and as the subject is one of much interest in reference to surgery and legal medicine, it requires brief consideration in this place. For practical purposes, they may be arranged under the following heads: first, where the canal opens on the upper or lower surface of the penis; secondly, where it terminates in the perinæum; and, thirdly, where it opens in front of the abdomen, just above the pubes. In *epispadias*, as the first of these malformations is styled, the preternatural orifice usually exists about an inch and a half behind the extremity of the penis; whilst, in *hypospadias*, it may be situated at any point between the gland and the scrotum, though its ordinary seat is opposite the neck of the organ, or just behind it. When the opening is in the perinæum, the under surface of the penis is sometimes deeply grooved, the fissure extending down over the scrotum, and giving rise to an appearance of hermaphroditism, especially if, as occasionally happens, the testicles are retained in the abdomen, and the penis is very diminutive.

When the opening is placed far back, the individual who is the subject of the malformation is generally impotent. To this rule, however, striking exceptions sometimes occur. I am acquainted with a colored man, a patient of mine, who, although the urethra terminates at the scrotum, at least four inches from the ordinary point, is yet the father of five children; and similar examples are to be found in every work on forensic medicine.

The urethra may be congenitally imperforate, and occasionally, though rarely, the meatus is double. Of the latter variety of malformation, examples have been recorded by Borelli,\* Fabricius,† Hildanus, and Platerus.‡ Baillie

\* *Historia et Observ.*, Cent. iv., Obs. xiii., p. 288.

† Cent. i., Obs. 76.

‡ *Obs.*, lib. iii., p. 844.



mentions an instance in which there were two canals, the one pursuing the natural course, while the other, which was about two inches in length, terminated at one extremity in a cul-de-sac, and at the other opened at the head of the penis, in the usual situation.\*

When the tube is imperforate the obstruction may exist in any part of its extent, anteriorly, at the middle, or posteriorly, towards the neck of the bladder. The canal is sometimes entirely absent, at other times it is only partially deficient, and occasionally, again, the closure is produced by a sort of membrane, extending from one side to the other, in the form of a hymen. Daams,† a Dutch writer, met with a case, in which the meatus was completely obstructed by the inflection of an elongated and adherent prepuce.

The effect of this congenital obstruction, or obliteration of the urethra, is great distention of the urinary bladder, with enlargement of the ureters, and a peculiar cystiform dilatation of the kidneys. These changes also show, what has not been admitted by all physiologists, that micturition is naturally performed before birth, and that the secretion of urine may be carried on even after the renal tissues are almost entirely destroyed. I subjoin the following cases in further illustration of these interesting facts.

Heer,‡ a German author, describes a case where the obstruction existed near the neck of the bladder, in the form of a membrane. The closure was complete. The bladder was excessively distended, and the ureters and pelvis of the kidneys enormously dilated. The parts are preserved in the Meckel Museum at Halle.

Sir Benjamin Brodie saw a full-grown male fœtus, with the orifice of the urethra congenitally deficient, and the bladder, ureters, and renal pelves all a good deal distended by a fluid which possessed all the properties of urine, except the want of uric acid.§

Dr. Ivanove, of St. Petersburg, dissected a child, born at the full period, which lived forty-eight hours, with the urethra imperforate, and the bladder and ureters much distended.||

In a case by Dr. Robert Lee, of London, the child was born at the eighth month; it had double hare-lip, and clubbed-feet; the abdomen was enlarged, the ureters were dilated, and the renal pelves contained, the one four, the other nine ounces of a fluid, which exhibited all the characteristic properties of urine.¶

Mr. Howship examined a male child, which was born alive at the eighth month, and died in a few hours. It had distorted feet, with imperforate anus, and the urethra, near the bladder, was impervious for a quarter of an inch. The bladder contained seven or eight ounces of clear limpid urine, and its coats, which were remarkably thick, had yielded posteriorly, so as to form a pouch. The ureters were as large as the finger, distended and contorted; and the kidneys, which were entirely divested of their natural structure, were converted into a congeries of vesicles or cysts, not exceeding the volume of a garden-pea, and loosely connected together by cellular substance.\*\*

In the case described by Mr. T. W. King, of London,†† the fœtus was supposed to have been more than four months old. The abdomen was distended, and contained about a quart of fluid, opaque, viscid, and of a dusky-reddish

\* Morbid Anatomy, p. 216.

† Verhandel. van het Genotsch. ter Bevordering der Heelkunde te Amsterd. 1793. Diel ii., No. vi.

‡ De Morb. Renum, p. 14.

§ Treatise on Urinary Complaints, &c., by John Howship, 1823.

|| Medico-Chir. Trans. of London, vol. xix., Paper by Dr. Lee.

¶ Lee, in Medico-Chir. Trans., l. c.

†† Guy's Hospital Reports, vol. ii., p. 508, 1837.

\*\* Op. cit.

color, with numerous flakes of fibrinous matter floating in it. The bladder, which reached to the umbilicus, without any appearance of a distended urachus, was large, and might have contained, originally, rather more than half a pint of water; its coats were much hypertrophied, and the general figure of the sac was globular, with a small cell extending into the prostate, as if it were the commencement of a urethra. Beyond this there was no excretory canal. A little behind the summit of the bladder the tunics were very much attenuated, and here a simple fissure existed, rather less than half an inch in length, which opened into the peritonæal cavity. The ureters, which were tortuous and somewhat thickened, were enlarged, chiefly inferiorly, much beyond the capacity of these tubes in the adult. The kidneys were small, slightly lobular, and not materially affected within by pressure.

A similar example is recorded by Billard, in his excellent "Treatise on the Diseases of Infants."\* The child was a still-born male; the bladder was enormously distended by a white fluid, and the urethra was obliterated at its posterior part; there was no prostate gland; the lower orifices of the ureters were perfect, but the diameter of these tubes was much increased, and the kidneys were nearly as large as a hen's egg, and considerably altered in their structure. There was no anus, and the rectum, examined internally, presented a complete cul-de-sac, closely adherent to the bladder. The other organs were natural.

*Morbid erection* of the penis is sometimes produced by inflammation, followed by an effusion of lymph into the cells of the cavernous bodies. I have never inspected a case of this kind after death, but observed one several years ago in a young mechanic, which lasted for nearly four weeks, in spite of the most rigid antiphlogistic measures. It came on soon after intercourse, and was attended with excessive pain, together with much constitutional disturbance. For several months after the violence of the disease had abated, the organ remained small, flaccid, and incapable of complete erection. Sometimes the priapism is caused by an effusion of pure blood; as in the interesting case related by Mr. Callaway, of London, and in which the individual continued permanently impotent.

The *pectiniform* septum of the penis is liable to be transformed into cartilage. I have never seen an example of this disease, but an instance once occurred to Dr. George McClellan, of Philadelphia, in which he was obliged, on account of the existing deformity, to perform a surgical operation. The individual was between fifty and sixty years of age; the disease had been coming on gradually; and the organ was curved towards the perinæum to such a degree as to interfere materially with sexual intercourse. The operation was entirely successful. Such a lesion, as the reader may readily conceive, might be a cause of impotence.

The fibrous sheath of the cavernous body of the penis is sometimes similarly affected. Boyer, Grainger, and Sir Astley Cooper have noticed examples of this kind.† The lesion is most common in persons who indulge too freely in sexual intercourse.

The penis is liable to be affected with *carcinoma*. The disease usually begins in one of the mucous follicles on the head of the organ, in the form of a little wart, from which it gradually spreads to the other parts, until the greater portion of it is destroyed. The ulcer, though deeply seated, is at first quite narrow; by and by it becomes broader and broader, and at last throws

\* See the able translation of this work by Dr. Stewart, of New York, p. 344.

† London Cyclopædia of Anatomy and Physiology, p. 266

out a cauliflower-like fungus. There is now a profuse discharge of thin, sanious, and offensive matter, the inguinal glands rapidly enlarge from the sympathetic irritation, and the patient is harassed with severe lancinating pains darting up towards the abdomen, his constitution being at the same time completely undermined by the local disease. Cancer of the penis is most common in old men that have suffered frequently from syphilis; but it may also occur in young persons, as the consequences of external injury.

It will scarcely be necessary, in a work of this kind, to say any thing concerning the different ulcers that are found on the penis, excepting such as are of a specific character. Amongst these, the most common are the herpetic, psoriatic, and syphilitic, each of which is worthy of brief notice.

*Syphilitic ulcers*, generally known by the name of *chancres*, although they may occur on any part of the body, invade the mucous texture always in preference to the cutaneous. Indeed, before the latter can be involved, it must be deprived of epidermis; for, so long as this preserves its integrity, it is impossible for the venereal virus to produce its specific effect. Their most usual seat is the inner surface of the prepuce, together with the neck of the penis, the orifice of the urethra, and the sides of the frænum. These ulcers vary extremely, both in size and number, being sometimes quite small, and at other times forming large sores. In the plurality of cases, there are not more than two or three; but occasionally there are as many as six or eight, appearing either simultaneously or following each other in pretty rapid succession.

It is now well ascertained that all chancres of the mucous membrane of the genital organs, both in the male and female, are originally of a pustular form. The only exception to this law is where the virus is applied to an abraded surface, which modifies the appearance of the sore, converting it at once into a running ulcer. It is highly probable, I think, that the matter is deposited, in the first instance, into the mucous follicles, where it excites a specific inflammation, eventuating in the secretion of a fluid, which is capable, in its turn, of creating a similar disease. What corroborates this opinion is the fact, just adverted to, that the chancre always begins in the form of a pustule, and that it is most apt to be developed in those situations which abound in muciparous glands.

The initial step of the disease is a small, reddish, indurated speck, the summit of which is speedily converted into a spherical vesicle, filled with a thin, colorless serosity. Its size scarcely equals that of a mustard-seed; and its parietes, being formed by the mucous epithelium, are so excessively delicate as to break upon the slightest touch. Hence it is frequently ruptured before an opportunity is afforded of inspecting it, which is the reason, doubtless, why it so long escaped the notice of pathologists. On bursting, the vesicle leaves a small circular ulcer, with hard, jagged, and abrupt edges, as if they had been cut vertically. The surface of the sore is grey, yellowish, or ash-colored, and the parts immediately around it are indurated, thickened, and of a deep, florid hue, being formed into a distinct, circumscribed tumor. The discharge is at first of a foul, sanious, irritating character; but by degrees it assumes all the properties of laudable pus. The induration commences about the fifth day; and, as was first remarked by John de Vigo, and afterwards by John Hunter, forms one of the most constant characters of chancre. It is about this period that the system begins to be in danger of contamination from the absorption of the virus.

A chancre appearing on the cutaneous surface generally begins in the form of a pimple, which is surrounded by a red areola, and contains a thin serous fluid, which, on the fifth or sixth day, becomes purulent. The part about this



period presents the aspect of a pustule, not unlike that of small-pox; and the structures on which it rests are somewhat indurated and œdematous, from the effusion of coagulating lymph. In a few days more the matter becomes thick, the pustule shrinks, and scabs begin to form, which, on falling off, expose deep, rounded ulcers, encircled each by a prominent, violet-colored ring. The scabs, which are thick, and often of a truncated, conical shape, are soon succeeded by others; and thus the disease proceeds until the part either gets well, or yields to the devastating influence.

Syphilitic ulcers are very apt to spread, and even to terminate in gangrene. The slough is small, circumscribed, and black at first, but afterwards more or less extensive and ragged. The entire chancre is sometimes thus lifted from its place, leaving the surrounding tissues in an inflamed and infiltrated condition, with a sore that can be easily healed. More generally, however, the ulcers assume a phagedenic character, and throw off fresh sloughs until the whole penis is involved in the ruinous mischief.

Many chancres, after having persisted for a variable time, gradually exhaust themselves, and finally cease spontaneously, the event being announced by the secretion of laudable pus, and the development of healthy granulations. In whatever manner the reparation is effected, whether by art or the efforts of nature, there almost always remains a hard, gristly tumor, which is more or less tender on pressure, very slow in disappearing, and extremely prone to new attacks of ulceration. Indeed, so common is this, that chancre may be considered, in the language of an ingenious writer, as a genuine phoenix, which springs from its own ashes, and furnishes the food for its own nourishment. So long as the disease is confined to the penis, it is strictly a local affection; but it has a tendency, sooner or later, to work its way into the system; the first evidence of which is generally a swelling of one of the lymphatic ganglions of the groin, known by the name of bubo.

Chancre alone can produce chancre. That this is the fact, appears to be conclusively established by the recent researches of Dr. Ricord,\* of Paris. This distinguished physician repeatedly inoculated persons with the mucopurulent matter of simple gonorrhœa, without succeeding in a single instance in producing chancre. He has also ascertained that it is during the ulcerative stage that the sore yields its specific secretion: after this has passed, it loses its character, its nature changes, and its poisonous property is destroyed. Dilution with other substances renders its operation not only uncertain, but at times completely inert. The part to which it is applied must likewise be free from acute inflammation, from purulent fluid, and from unctuous matter.

The time intervening between the application of the virus and the development of the chancre is very uncertain. Occasionally the disease follows in the course of twenty hours; at other times — and this is most generally the case — several days elapse; and, in some instances, it does not make its appearance under a few weeks. The nature of the part affected seems to exert some influence upon the production of chancre. Thus, the prepuce is more easily diseased than the gland, and the latter than the skin of the penis and of the scrotum.

*Herpetic* ulcers are only observed in adults, generally on the inner surface of the prepuce, though also sometimes on the skin. They manifest themselves by inflamed spots, of a bright red color, varying in size from that of a millet-seed to that of a split pea. Small vesicles soon succeed, of a globular shape, remarkably transparent, agglomerated, and containing at first a serous, and

\* Edinburg Medical and Surgical Journal, vol. x., l. ix., p. 479.

subsequently a puriform fluid. On the internal surface, these vesicles lead to the development of thin, flat scales, which fall off about the fifth day, leaving a corresponding number of round, yellowish excoriations: on the external surface, rough, irregular scabs form. This disease is very apt to recur. It is usually attended with some itching, rarely with real pain. Friction and want of cleanliness are the principal exciting causes. By running together, these ulcers occasionally form one unbroken sore, occupying nearly the whole of the prepuce. From experiments made by Mr. Evans, of England, it appears that the matter secreted by these ulcers is not contagious.

The *psoriatic* ulcer is most frequently met with in persons who have the fore-skin unnaturally long, moist, and tender. It is an obstinate and painful disease, characterized by deep cracks, or fissures, on the edges of the prepuce, which becomes gradually thickened, hardened, and so corrugated as to occasion phymosis. The number of ulcers is sometimes quite considerable: they are very tender and unseemly; apt to bleed when injured; extremely difficult to heal; and, if large, attended with a very copious, puriform discharge. Small, brownish-looking scales occasionally form on these sores.

A not uncommon consequence of gonorrhœa and syphilis is the development of *warty excrescences*, principally around the neck of the gland and by the side of the frænum. The number of these growths is frequently very great. I have repeatedly seen from fifty to one hundred, and in one instance I found the surface of the gland literally covered with them. Their volume varies extremely, being sometimes quite small, and at other times constituting large tumors. They have generally narrow necks, with thick, rough bodies; are of a firm, fibrous consistence, and of a pale greyish color, with various shades of red. When injured, they are sometimes painful, and apt to bleed. On being extirpated, they often reappear.

It is unnecessary here to say any thing, particularly in reference to *phymosis* and *paraphymosis*, two congenital malformations, consisting, the one in an inability to retract the prepuce, the other in an inability to pull it forward. Both these states may be the result of accident, and are often met with in association with gonorrhœa and syphilis.

When the prepuce is very long and phymotic, it is liable to become the receptacle of calculous concretions. Examples of this occurrence have been recorded by Petit, Bonn, Pallas, and other writers. Vicq d'Ayr\* observed a case in which the foreign substance had attained the weight of three ounces; and in a young man, twenty-one years of age, affected with congenital phymosis, Walter† found not less than sixty concretions between the prepuce and head of the penis. They were of a greyish ash color, smooth, solid, of a circular shape, with flattened sides, and varied in diameter from three to five lines by a line or two in thickness. Altogether they weighed two drachms and one scruple. In another case, that of a man thirty years old, the same writer found twenty-two concretions in this situation.

It is not easy to determine whether these foreign bodies are originally formed under the prepuce, or in the urinary apparatus. The probability is that they are contained in the urine, and that they are separated from this fluid in its passage through the narrow and contracted aperture in the fore-skin.

\* Hist. de l'Académie de Médecine, 1780-1.

† Observ. Anatom., p. 54.—Voigtel, Handbuch der Path. Anatomie, B. 3, s. 377.

## CHAPTER XXVII.

## OF THE FEMALE ORGANS OF GENERATION.

## SECTION I.

## OF THE UTERUS.

1. *The Uterus*.—Situation and Shape.—Observations on its Weight and Volume.—Is composed of a peculiar Substance.—Liable to Malformations.—Retroversion.—Prolapsion and Inversion.—Is apt to suffer from Inflammation, both of its Lining Membrane, its serous Covering, and its proper Tissue.—Remarks on Uterine Phlebitis.—Softening.—Induration.—Atrophy.—Fibrous Tumors.—Different Species of Polypes.—Calcareous Concretions.—Transformation of the Uterine Tissue into Cartilage and Bone.—Malignant Diseases.—Encephaloid and Scirrhus.—The Corroding Ulcer and Cauliflower Excrescence of Clarke.—Tubercular Deposits.—Rupture.—Hemorrhage.—Accumulation of Air.—Hairs.—Obstructions of the Mouth of the Womb.—Hydatids.—Uterine Molcs. II. *The ovaries*.—Normal Characters.—Their Disorders are numerous and important.—Osseous Transformations.—Serous Cysts and Hydatids.—Scirrhus.—Occasionally contain Teeth, Hair, and Fragments of Bone.—Hemorrhage.—Remarks on the Corpora Lutea. III. *The Fallopian Tubes*.—How organized.—Are seldom affected with Disease. IV. *The Vagina and Vulva*.—Liable to the same sort of Maladies as the other Mucous Structures.—Polypes of the Vagina.—Varices.—Enlargement of its Mucous Follicles.—Vices of Formation.—The Great Labia.—Polypes.—Clitoris.—Nymphæ, and orifice of the Urethra. V. *The Mammary Gland*.—Structure, Volume, and Color.—Is often the seat of Acute and Chronic Inflammation.—Its Diseases, in many respects, resemble those of the Testicle and Ovary. VI. *Placenta*.—Structure.—Inflammation.—Suppuration.—Softening.—Cartilaginous Degeneration.—Ossification.—Hypertrophy.—Tubercles.—Sanguineous Effusions.—Umbilical Cord.

THE sexual system of the female consists of the uterus, Fallopian tubes, ovaries, the vagina, vulva, and mammary glands. Previously to the age of puberty, the uterine organs are extremely small, and as they do not exert any particular influence on the constitution, they are not at all prone to disease. When they have attained their full development, however, their importance is deeply felt by the system at large, and they then become subject to a great variety of morbid alterations, both of a functional and organic character, which either impair the general health of the female, or terminate in destructive mischief.

In women who have borne children, the womb is always larger, and its substance more firm and dense; its lips, also, are more ragged and irregular, and sometimes, though rarely, the orifice of the organ is obliterated. Morgagni refers to a case where the closure was effected by the growth of an adventitious membrane, and similar examples have since been recorded by other writers. Occasionally, though rarely, the uterus and the vagina have been known to form one solid mass, without any cavity or opening in either.

Situated obliquely within the pelvic cavity, the uterus is in contact, above, with the folds of the small intestines, in front, with the urinary bladder, and behind, with the rectum. Inferiorly, it is intimately connected with the vagina, forming an angle with it of about forty-five degrees. In its shape, it is pyriform, the broader part being above, and the narrower, which is called the neck, below. It is closely invested by two folds of the peritonæum, and is kept in its position principally through the agency of the round ligaments, which are attached, on the one hand, to its upper and lateral aspect, and, on the other, to the cellular substance of the groin and pubes.

The weight and dimensions of the uterus vary very much in different individuals, as well as at the different periods of life. In six specimens taken from young virgins, soon after the establishment of the menstrual function, I found the average weight to be one ounce and a half, the minimum one ounce,



and the maximum one ounce and three-quarters : the medium length was two inches seven lines ; the breadth, from one Fallopian tube to the other, eighteen lines ; and the thickness ten lines and a half. Of the neck, the length was fourteen lines, the breadth eleven, and the thickness eight. The lips, which varied in thickness from three to four lines, were perfectly smooth and rounded, and enclosed a circular orifice scarcely a quarter of an inch in diameter. In two of the specimens the aperture presented the appearance of a transverse slit. The horizontal diameter of the inferior extremity was eight, the antero-posterior, seven lines. The medium thickness of the parietes was five lines at the body, and four at the neck. The length of what is termed the fundus of the organ rarely exceeds the fourth of an inch.

The dimensions of the virgin uterus are stated by Madam Boivin and Professor Duges\* to be the following.

Total length	-	-	-	26 lines.
Breadth of the fundus	-	-	-	17 „
Thickness	-	-	-	8½ „
Length of the cervix	-	-	-	13 „
Breadth	-	-	-	9½ „
Thickness	-	-	-	7 „

Of the walls of the body of the organ the thickness, above, was five lines and a half, laterally five lines, posteriorly four lines and a half, and anteriorly four lines. The entire weight, without the appendages, was five drachms. The woman, who was twenty-five years of age, had never been married ; her stature was moderate, and the menstrual function had always been regular.

In married women who have borne children, the same writers estimate the weight of the uterus at from one ounce and a half to two ounces ; the total length, at from two and a half to three inches. The length of the body is two inches ; of the cervix, from thirteen to fifteen lines, the breadth of this portion being eighteen lines. The thickness of the body is fourteen lines, and sometimes much more ; of the cervix, from eight to ten lines ; of the contracted part, eight lines ; of the parietes of the body, six lines. The breadth of the vaginal orifice is stated at six lines.

The cavity of the uterus, very small in proportion to the thickness of the parietes of the organ, is marked off, though very faintly, into two lateral halves by two slightly-raised longitudinal lines, running along its anterior and posterior surfaces. In shape it is somewhat triangular, being much wider above than below, where it gradually assumes a cylindrical appearance, conforming thus to the external configuration of the neck. A very smooth, delicate, mucous membrane, evidently a prolongation of that of the vagina, but considerably modified in its structure, is reflected into this cavity, and furnishes it with a complete lining. It is of a light pink color, except during menstruation, when it is generally of a florid complexion, and is so intimately adherent to the proper substance of the viscus, that Morgagni, Azzogindi, Chaussier, and many others, have been induced to deny its existence,—an opinion, however, which is not only opposed by analogy, but by numerous pathological facts. In the neck of the womb the membrane is thrown into very delicate, oblique folds, which are more conspicuous in virgins than in females who have borne children, and which are arranged into beautiful arborescent lines. Throughout its entire extent, but more particularly at the mouth and

\* Op. cit., p. 10.

neck of the organ, it is studded with mucous follicles, which are so minute, in the healthy state, as to render it difficult to demonstrate them, but which are always rendered prominent during gestation and in certain diseases.

The proper substance of the uterus seems to be peculiar. In appearance it is not unlike a half-tanned hide, and in consistence it is so dense and firm that it is not easily cut with the knife. Varying in thickness from four to six lines, it is composed of strong, elastic fibres, of a yellowish buff color, which intersect each other in every conceivable direction. With respect to the proximate nature of this texture, writers are still much divided in opinion; for, whilst some assert that it is essentially muscular, others are disposed to look upon it as being altogether peculiar, and consequently unlike any other substance in the body. Vesalius, the great restorer of anatomy in the seventeenth century, describes three layers of fleshy fibres, one of them as being arranged transversely, the second perpendicularly, and the third obliquely. Malpighi speaks of them as constituting a sort of network; and Ruysch maintains that they appear in particular parts of the organ, especially at the base, in the form of orbicular muscles. In the admirable plates of Dr. William Hunter, they are represented as being transverse in the body of the uterus, and concentric at the base. This subject has been more recently investigated by Sir Charles Bell, an account of whose observations may be found in the fourth volume of the London Medical and Surgical Society. This distinguished anatomist asserts that the muscular fibres of the womb can be as easily demonstrated as those of any other organ; and he supposes that their presence is absolutely necessary to enable us to explain the powerful contractions which take place during labor. It would seem, from his dissections, that the circular fibres prevail at the base, and the longitudinal in the body and neck. According to Madame Boivin, again, an eminent Parisian midwife, the substance of the womb consists of two fleshy cones, of which the outer is composed of longitudinal, the inner of circular fibres; a disposition similar to that which obtains in the intestinal canal.

In opposition to this view, concerning the muscularity of the uterus, might be arrayed the names of many of the most distinguished anatomists of the last and present centuries; but to do this would far exceed the limits of the present treatise, and I shall therefore content myself with observing that, so far as a careful examination of this substance, both in the healthy, impregnated, and diseased state of the organ enables me to judge, I am compelled to believe that it is of a peculiar nature, altogether unlike any other texture in the body. Not only is this conclusion sanctioned by the results of numerous and well-conducted dissections, but, if analogy be allowed to have any weight in the argument, it is wholly on that side of the question which I have just taken. Indeed, it may be assumed as an established anatomical fact, that the structure under consideration does not possess a single characteristic attribute of the muscular tissue, with the exception of its contractile power; and this, it is well known, is much greater, in proportion to the volume of the organ, than that of any other muscle in the whole body. Instead of being red and soft, it is pale and firm; and, as it is a doctrine in physiology that the strength of a muscle is always in direct ratio to the depth of its color, it might justly be expected that the fibres of the uterus would be of a transcendently florid hue, which, however, is not the case. Additionally to all this, it may be remarked that no chemist, at least so far as I am acquainted with his writings, has succeeded in obtaining fibrin, the proximate element of muscular substance.

Nor do these fibres, as they are termed, observe any particular arrangement. With the exception of the neck of the uterus, where they are appa-

rently circular, they run in all directions, crossing each other at various points, and thus forming a strong, dense, and resisting web.

This organ is very plentifully supplied with blood-vessels, absorbents, and nerves. The arteries are derived from the spermatic and hypogastric, the former being distributed chiefly to the base of the womb, the latter to the body and neck. Anastomosing freely with each other, they are remarkably tortuous, and thus accommodate themselves readily to the great changes which the organ experiences during pregnancy. The veins are exceedingly numerous, and still more serpentine than the arteries. During gestation they greatly augment in volume, and thus constitute what Haller has termed the uterine sinuses, some of which are sufficiently large to admit the point of the little finger. The absorbents are likewise extremely numerous, and, as in the other viscera, are arranged into two sets,—a superficial and deep-seated.

The nerves are furnished by the sacral and hypogastric plexuses. It is through the filaments of the latter that the uterus is connected with the great trisplanchnic system, and that so many of the other viscera, especially the stomach, so completely sympathize with it, both in its impregnated and diseased state. So fully were some of the ancient physicians and philosophers impressed with the peculiar properties of this organ, that, without being probably aware of this nervous connection, they regarded the womb as “an animal within an animal.”

Before we proceed to speak of the diseases of this organ, it will not be amiss to make a few remarks concerning some of its more important *malformations*, a subject which is not only interesting to the pathological anatomist, but likewise to the medical jurist, to the latter of whom, especially, a knowledge of them is indispensable. Various attempts have been made to classify these vices, but I am not certain that they have resulted in much good. A plain statement of facts is all that I shall aim at on the present occasion. The subjects that will be treated of are, first, entire absence of the uterus; secondly, deficient evolution; and, thirdly, increase of development.

1. Authors have sometimes noticed an entire absence of the uterus. Examples of this description have been recorded by Columbus, Meyer, Klintosch, Bousquet, Engel, Boyer, Walther, Macfarlane, Dupuytren, and other writers. In Voigtel's *Manual of Pathological Anatomy*,\* a work which abounds in profound erudition, and which should be in the library of every intelligent physician, may be found a copious list of references to cases of this variety of malformation. In some of these examples, indeed in nearly all, this congenital vice was connected with absence of the ovaries and the Fallopian tubes. The vagina was also frequently wanting; and the external parts of generation were either completely deficient, or represented as it were in miniature. When the ovaries were present, the vulvo-vaginal structures were more perfect, the mammary glands more expanded, and the females possessed more of the characteristic attributes of their sex.

2. There also, secondly, occur cases in which the womb is remarkably small, or in which it exists only in a rudimentary state. Professor Julius Cloquet,† the distinguished anatomist, exhibited, some years ago, to the Medical Faculty of Paris the sexual organs of a young woman, twenty-two years of age, where the uterus was not larger than that of a child of twelve months. The vagina was also very small; but the ovaries and Fallopian tubes were, on the contrary, quite well developed. Cases not unlike this are to be found in various periodicals, but, on the whole, they are rare.

3. There are other deviations from the normal standard deserving of brief

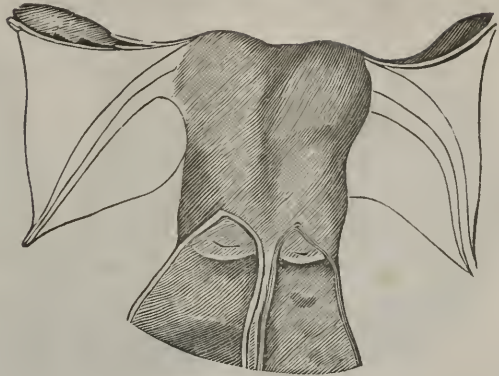
\* Band, i., s. 472.

† Journ. Gén. de Méd., t. lxx., p. 274.



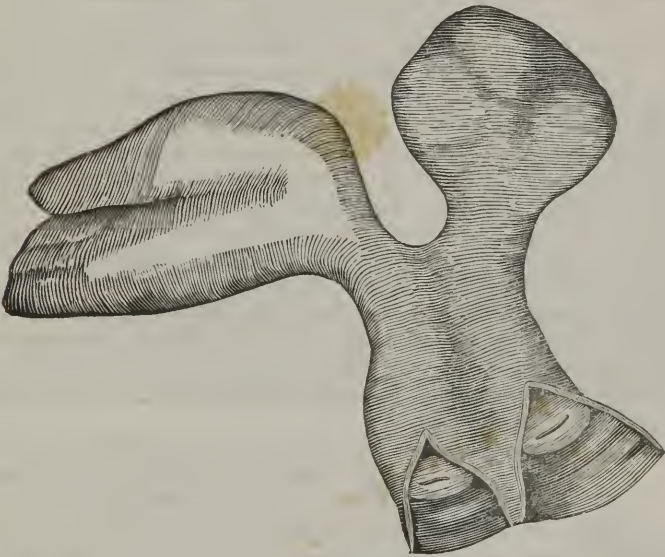
notice in this place. Among these the most common are, where the uterus presents the appearance of being bilobed, or where it is prolonged superiorly into two shoulders or horns. In the first variety (Fig. 216), the organ is of an elongated cylindrical shape, and is divided, by a longitudinal septum, into two parallel canals, precisely alike in size and figure, and opening separately into a common vagina. In a few cases, however, the canals have each an appropriate vagina. In the

Fig. 216.



bicorned uterus (Fig. 217), the base and body of the organ are extended upwards into two conical horns, from six to fifteen lines in length, and from eight

Fig. 217.

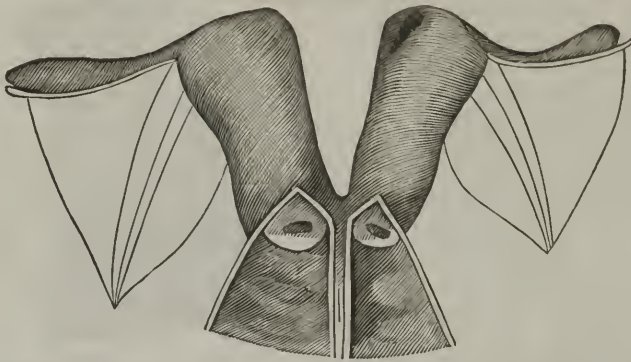


to twelve in breadth, the neck and mouth retaining their natural conformation. This variety, which is not uncommon in grown-up females, is of frequent occurrence in monsters. Finally, there is a third form of congenital vice, the bipartite (Fig. 218), as it may be termed, which presents a much greater departure from the natural condition than either of the others; here the organ is really double, or it consists of two distinct and separate portions, generally connected by a thin, narrow isthmus of matter, and both opening into the vagina, which may be either single or double, or one into the vagina, and the other into the rectum. Of this mode of communication, an interesting example has been recorded by Vallisnieri. Occasionally the cavity of one of the uteri is impervious.

All these deviations from the normal formation are perfectly compatible with impregnation. In some case they are associated with absence or deficient development of the ovaries and Fallopian tubes; but, generally speaking, these

structures are present, as in the natural state. In no instance, so far at least as my knowledge extends, were there two ovaries and two Fallopian tubes on each side, not even in the bipartite variety, the nearest approach.

Fig. 218.

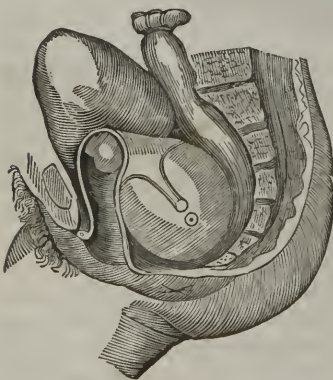


In women who have borne children, the womb is always larger than in virgins, or than in those who are barren: its substance is also more dense and firm, its lips are more jagged and irregular, and sometimes, though rarely, the orifice of the organ is completely obliterated. Morgagni refers to a case where the closure was effected by the growths of an adventitious membrane; and similar examples have since been recorded by others. The occlusion may also be produced by inflammation attended with an effusion of plastic lymph. The orifices of the Fallopian tubes are also sometimes closed, either congenitally or as the effect of disease. In a few rare instances the uterus and the vagina have been known to constitute one solid mass, without any cavity or opening in either; and occasionally, again, though this is also very infrequent, the cavity of the former is divided, by a transverse septum, into two chambers, one corresponding with its base, the other with its neck. This lesion is most common in very old females, and is generally, if not invariably, the result of inflammatory irritation, leading to adhesion of the isthmus of the organ.

Of the various *malpositions* to which the uterus is liable, not much need be said in a treatise on pathological anatomy. Those which we shall briefly notice on this occasion may be comprised under the heads of retroversion, anteversion, prolapsion, and inversion.

In *retroversion* (Fig. 219), the orifice of the uterus is tilted up against the pubic symphysis, and the fundus is thrown downwards and backwards, so as to form a tumor between the vagina and the rectum. Thus the axis of the organ is totally reversed relatively to its natural situation within the pelvis. This species of displacement is most apt to occur between the third and fourth months of pregnancy; it may, however, take place at a much later period; and, in some instances, it has been noticed soon after delivery. Its progress, though occasionally gradual, is generally rapid.

Fig. 219.



*Anteversion* (Fig. 220) is a displacement precisely the reverse of the preceding, that is to say, the fundus of the womb is carried forwards on the urinary bladder, and the mouth backwards towards the rectum and the hollow



of the sacrum. It rarely occurs during pregnancy, and is almost always associated with hypertrophy of the uterus. The anteversion is sometimes produced by morbid adhesions between this organ and the peritonæum, which have the effect of forcing it out of its normal position.

Notwithstanding the uterus has four ligaments which serve to maintain it in its natural position within the pelvis, it not unfrequently happens, both in its empty and gravid state, that it loses its hold, and falls down into the vagina, or even through the vulva. In the latter case, the organ forms a tumor between the thighs, with a small central aperture corresponding to the mouth of the womb, and the vagina is completely inverted, or pulled inside out. This prolapsion is always attended, especially when complete, with severe dragging pains, and a thick muco-purulent discharge.

*Inversion* of the uterus is that displacement where the viscus is turned inside out. (Fig. 221.) It is generally attended with more or less prolapsion of the body of the organ, and seldom happens except during delivery of the after-birth, or the forcible removal of some tumor from its interior. Of this lesion there may be several degrees. In the first, the fundus falls down to the mouth of the womb, where, from some obstacle or other, it is arrested; in the second, it passes beyond this point for half or more of its length; and, in the third, the whole organ escapes at the inferior orifice. In the second case, it is obvious that the body and the fundus may be compressed, or strangulated, by the contraction of the neck.

The uterus is liable to *inflammation*, both in the married and in the single female, but much more frequently in the former than in the latter. The disease may attack any portion of the organ, the lining membrane, the parenchymatous substance, or, finally, the peritonæal covering; and, in some instances, though this is rare, all these structures may be involved simultaneously, together with the venous and absorbent trunks.

When the disease affects the *lining membrane*, all the phenomena will be present that are observed in inflammation of the mucous textures in other parts of the body. The redness, which is of a deep shade, is often spread over a large extent of surface, and in violent cases it is not uncommon to meet with small ecchymoses, followed by an escape of blood on pressure. The mucous follicles, especially those about the mouth of the uterus, are in a state of enlargement, and there is usually, in the course of a few days, a great increase of the natural secretion. In some instances, pus is deposited, and continues to be discharged for a considerable period, as in inflammation of the mucous membrane of the vagina.

Fig. 220.

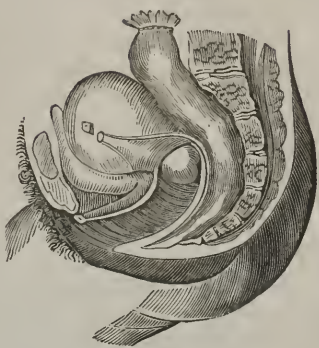
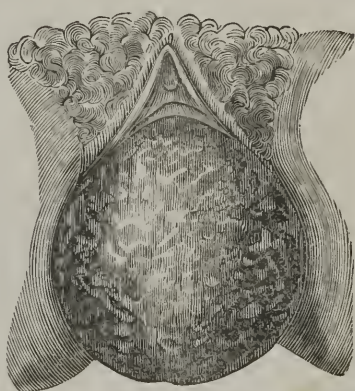


Fig. 221.





Occasionally the lining membrane is affected with a sort of specific inflammation, eventuating in the effusion of coagulating lymph. It is very often seen in young females of a robust, irritable temperament, in whom it constitutes a frequent cause of dysmenorrhœa. The membranous concretion, which is seldom thick or firm, generally moulds itself to the inner surface of the uterus, and is sometimes expelled entire, though much more commonly in small pieces; in some cases it is probably absorbed. The period required for the extrusion, varies from a few hours to one or two weeks, and is almost always attended with considerable suffering. When the lymph extends into the Fallopian tubes, it may lead to sterility, as it prevents any thing from passing along them.

The immediate cause of the production of this membrane is inflammation, not of the proper structure of the uterus, but of its inucous lining. That this is the case, is sufficiently proved by the great suffering which is so often present. What do the severe pelvic pains, the sense of fulness in the region of the womb, the hot and feverish skin, the tense and accelerated pulse, indicate, but a congested and irritated state of this organ, amounting to inflammation? Analogy, also, affords us good grounds for this opinion. Lymph is never thrown out by parts, unless they are in a state of inflammation. The adventitious membrane of pleuritis, of croup, and of enteritis, is always dependent upon this cause, and upon none other. If, then, this be true here, why should it not be true also in regard to the uterus?

Inflammation of the body and serous covering of the uterus is most common in females during the first eight or ten days after parturition. It sometimes betrays an epidemic tendency, and rapidly passes into suppuration, softening, or even gangrene. The pus that is poured out in such cases may be situated in the parenchymatous structure, in the uterine cavity, the subserous cellular substance, between the folds of the broad ligaments, or, finally, in the venous or absorbent trunks. In most of the localities here referred to, it occurs in the form of small yellowish-looking globules; but cases are occasionally observed in which the fluid is collected into one or more abscesses, which are never very large, and which manifest a disposition, sooner or later, to burst into the vagina, the rectum, pelvis, or urinary bladder. The pus is generally blended with a good deal of lymph, and is sometimes highly offensive.

Inflammation of the *uterine veins*, although of very frequent occurrence, does not seem to have attracted much notice until a very recent period. For our knowledge concerning it we are mainly indebted to Professor Meckel, of Germany, Dr. Lee, of England, and to Dance, Tonellé, and Cruveilhier, of France. From the researches of these and other anatomists, it appears that uterine phlebitis is an extremely common disease, and that it is a frequent cause of the fatal termination of what is vaguely termed puerperal fever. The lesion may originate in and be limited to the veins; but, in the great majority of cases, the parenchymatous structure participates in the inflammation, and assumes a dark livid aspect, at the same time that it loses its natural consistence. Serum and pus may also be found in the subserous cellular tissue; and the peritonæal investment is sometimes covered with thick patches of lymph. The veins themselves are always much enlarged, and their cavities are filled with pus, clots of blood, or plugs of adventitious membrane. The disease often extends along the venous trunks of the pelvis to those of the abdomen, or even to those of the inferior extremities; and very frequently the absorbent vessels are similarly circumstanced, being greatly augmented in volume, and infiltrated with enormous quantities of purulent matter. The causes of uterine phlebitis are not always very evident. In some cases, it appears to result from violence done in the extraction of the placenta, and, in others, it may be traced

to the effects of cold and moisture, irregularities of diet, or to some peculiar noxious condition of the atmosphere. As to the symptoms, we are equally in the dark, none having yet been pointed out that can be considered as pathognomonic. The lesion is said to be more frequent on the right side than on the left, and to be sometimes entirely limited to the veins in that situation.

*Softening* of the uterus is probably a very rare affection, at least I should think so from my own experience. The disease has hitherto been found chiefly in the persons of lying-in females. Of two hundred and twenty-two fatal cases of puerperal fever, observed by Dr. Tonellé, in the Maternity Hospital, at Paris, in 1829, there were forty-nine in which the parenchymatous structure of the uterus was more or less softened, and of a dark livid color. In most cases, it is confined to the neck or inner surface of the viscus, seldom penetrating to or commencing in its exterior. Here, as elsewhere, the mollescence presents several stages, running insensibly into each other. In the first stage, the uterine substance is preternaturally flaccid, lacerable, and infiltrated with serosity; in the second, it readily yields under pressure, and may be broken up into a soft, stringy texture, like that of the spleen; in the third, when the disorganization is at its maximum, it is of a semi-fluid consistence, and scarcely retains any trace of its former character. The softened organ sometimes preserves its natural color, but more commonly it is remarkably pale, greyish, or even brownish. Occasionally, where the attending inflammation is violent, and runs its course very rapidly, the color is purple, slate, or black, and occurs in patches, varying in diameter from a split pea to a twenty-five cent piece.

Frequently this disease continues for a considerable period, and yet the woman does not seem to be aware of its presence. That it is the result of inflammatory irritation, generally of an acute kind, appears sufficiently obvious, both from its anatomical characters, which have just been enumerated, the rapidity of its progress, and the symptoms which indicate its existence during life. Commonly these phenomena are extremely vague, and hence the diagnosis is always difficult. A sense of weight in the pelvis, a dull, aching pain in the hypogastric region, augmented by pressure, uterine hemorrhage, and febrile exacerbations, together with a remarkable prostration of the mental and physical energies, are the usual accompaniments of this singular lesion. This state of the uterus sometimes terminates fatally, either by rupturing the organ, or by bringing on gradual exhaustion; and, what is remarkable, we not unfrequently find it associated with mollescence of the other viscera, especially of the stomach and the heart.

It sometimes happens, though not often, that the substance of the womb is preternaturally hard. This change, which may exist with or without mollescence, is very different from scirrhus. It is characterized by unnatural paleness, and by a dense, firm, and almost incompressible state of the uterine tissue. There are no symptoms by which *induration* of the womb can be recognized during life. It seems to be the result of chronic irritation, going on, there is reason to believe, often for a long period, and is most commonly found in connection with scirrhus, encephaloid, and polypes, in females who have ceased to menstruate.

The uterus is one of those organs which are affected by old age. Indeed, *atrophy* from this cause is by no means rare. During the decline of life, the viscus increases in density, and exhibits a proportionate diminution in weight as well as in volume; many of its vessels are obliterated, and its cavity is nearly, sometimes entirely effaced.

Prolonged inactivity will, even at a comparatively early period, cause atrophy of the uterus. In women who have never borne children the organ is

often considerably smaller than in those who have been repeatedly pregnant. The uterus, in such cases, is governed by the same laws as the other parts of the body, which are large or the reverse in proportion to the amount of their exercise and the consequent influx of blood.

Continued pressure, as from the presence of a fibrous tumour, an enlarged ovary, or an exostosis of the pelvic bones, may produce this lesion. The proper substance, under these circumstances, is sometimes entirely removed, so that when the organ is distended with air it is as thin and diaphanous as a bladder. When the atrophy is carried to this extent, perforation may take place, and the secretions of the organ, if not suspended, be discharged into the peritonæal cavity.

Atrophy of the uterus sometimes occurs during gestation; it may be very slight, or so great that the parietes shall not be more than a line or two in thickness. The causes of this form of atrophy are not understood. It may be accompanied by loss of color and cohesion; or the organ may retain its natural complexion and firmness. Gestative atrophy of the uterus is frequently followed, especially during labor, by laceration.

Chronic inflammation of the uterus is often attended with an extraordinary development of its mucous glands. The enlargement is most conspicuous about the mouth and lip of the womb, where the follicles are sometimes as big as a hemp-seed, a currant, or even a pea, dense, almost gristly, and of a white greyish color. (Figs. 222 and 223.) The parts between them are generally tumid, red, morbidly sensitive, and

Fig. 222.

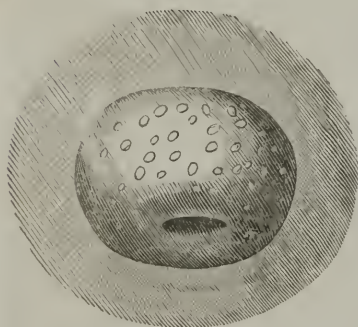
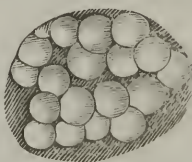


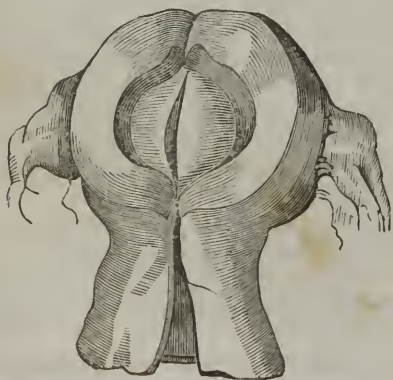
Fig. 223.



disposed to bleed. In several cases, I have seen the enlarged glands transformed into considerable cysts, filled with a pale, tremulous substance, easily removed by pressure. It is in this manner, perhaps, that the greater number of diseases of the mouth of the uterus, whether benign or malignant, originate.

One of the most common appearances observed in the uterus is the development of *fibrous tumours* (Figs. 224 and 225), occurring either in its substance, in its cavity, or on its outer surface beneath the serous coverings. Their shape is usually spherical; their diameter from the size of a hickory-nut to that of a melon; their structure firm, dense, opaque, and of a light greyish color, tearing into strong, concentric fibres. (Fig. 226.) Such excrescences have sometimes a rough, granulated texture, and not unfrequently they contain small cavities, filled with earthy matter, or various kinds of fluids, such as serum, jelly, blood, or pus. The calcareous matter, which in some instances almost

Fig. 224.





encases these morbid growths, in the form of a thin, brittle shell, not unlike that of an egg, has been shown, by Dr. Bostock, to consist chiefly of the phosphate and carbonate of lime, together with a minute quantity of animal sub-

Fig 225.

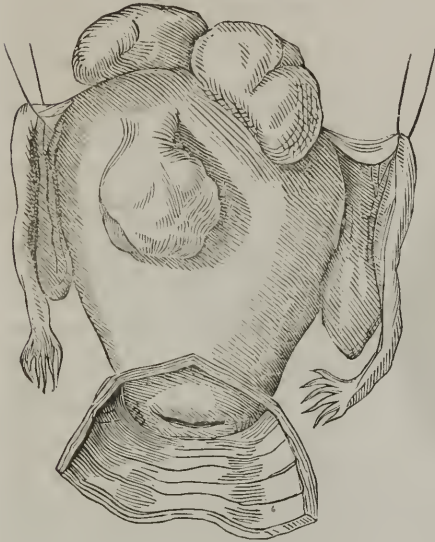
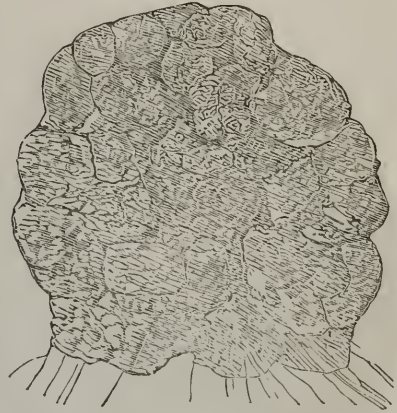


Fig. 226.



stance. It is generally of a pale greyish complexion, very soft and porous, like pumice-stone ; but examples are recorded where it had the hardness of ivory, and admitted of a fine polish.

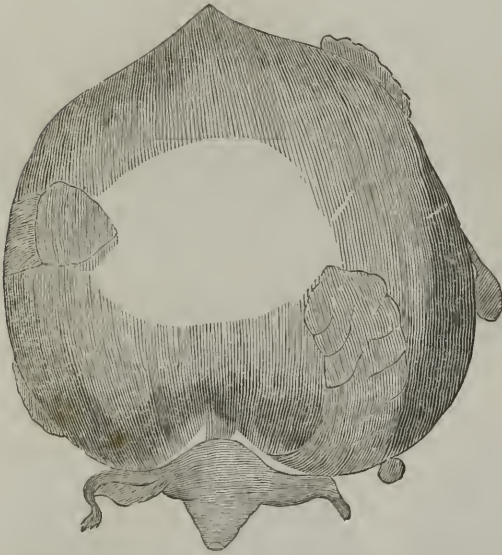
Only one such tumor sometimes exists in the uterus ; whilst at other times there are as many as six, eight, ten, or a dozen. When large, they are usually irregularly lobulated, or divided by deep fissures ; blood-vessels, often of considerable magnitude, can be traced into their substance. They have no disposition to ulcerate, to become soft, or to degenerate into malignant disease ; and, although they occur both in the married and the unmarried female, they seldom if ever make their appearance before the age of puberty.

When seated under the serous covering of the uterus, these tumors often hang by a very slender neck, and they then assume a pyriform shape. They possess very little sensibility ; and, so long as they remain small, they produce no change in the form of the uterus, or local inconvenience ; but, when they attain a large bulk, they often incommode, by their weight, and, by the pressure which they exert upon the bladder and the rectum, may seriously interfere with the expulsion of the urine and fæces. When these bodies are embedded in the walls of the womb, or spring from its inner surface, the subjects of them are apt to be barren ; or, if they conceive, the uterine tissue is unable to undergo the necessary expansion, and abortion results. Sometimes these tumors are attached to the base of the womb, and, by rising into the abdomen, may be felt moveable in that cavity, and thus simulate pregnancy. When situated in the uterine cavity, they are occasionally expelled during labour, and the woman either recovers, or dies of the profuse hemorrhage that ensues.

In the fourth volume of the American Medical Recorder are detailed two highly interesting cases, by Professor Francis, of New York, of fibrous tumors

growing from the external surface of the uterus, of which the following is a brief abstract. In the first, the woman was thirty-two years of age; during the last six of which she was married, but never proved pregnant. The womb was of the natural size, and everywhere healthy, except at its base, where it

Fig. 227.



gave attachment, by means of a narrow foot-stalk, to an immense tumor (Fig. 227), which weighed more than one hundred pounds, and filled the whole of the abdominal cavity, putting the integuments and muscles greatly on the stretch. It was of a pale reddish color, and of a fibro-vascular structure, looking a good deal like a mass of flesh. The surface of this morbid growth was covered with several excrescences, the largest of which weighed nearly two pounds; and in its interior was contained a large sac, which discharged three quarts of purulent and highly offensive matter. The disease had existed five years. The annexed engraving will convey a better

idea of the nature and extent of these tumors than any description, however elaborate.

In the other case, which occurred in a female, aged forty, the uterus had attained the size it usually has at the sixth month of pregnancy: its walls were one inch and a fourth in thickness, and the substance itself was in many parts ossified. Internally, at the fundus, was attached, by a short pedicle, a round, bony tumor, about the size of a small orange; and a similar body occupied the uterine extremity of the Fallopian tube: the corresponding ovary was hypertrophied, but otherwise sound. There were other appearances still more extraordinary. Near the neck of the womb were six large oblong tubercles, adhering by small narrow foot-stalks, and branching out in different directions, so as to fill the abdomen as high up as the umbilicus: they were of a vascular texture, of a pale reddish color, very firm, dense, resisting, and bore evident marks, in many places, of ossification. The weight of the diseased uterus was upwards of thirty-two pounds. The patient died apoplectic. Her principal ailments were, an acrid discharge from the uterus, a sense of fulness and oppression in the pelvic region, cessation of the menses, and occasional irritation of the stomach and bowels.

These fibrous growths, which are most common in old women, are seldom met with before the age of thirty. Bayle estimated that they existed in one case out of every five after the middle period of life. This may be true of the French, but certainly not in regard to the females of this country, in whom these tumors, so far at least as my own observation goes, are far from being frequent. Old maids are said to be particularly liable to them.

As intimately connected with the lesion just described, I may advert here briefly to what are termed *polypous* tumors of the uterus. This is a subject

which, notwithstanding the great attention that has been bestowed upon it by the profession, is still involved in great obscurity, scarcely any two writers agreeing upon the real nature of these morbid growths. Without entering at all into the discussion of the matter, which my limits will not permit, it appears to me that all such tumors may be conveniently arranged according to their anatomical characters, into four classes, namely, the fibrous, vascular, vesicular, and granular.

The first variety bears a strong resemblance to the fibrous tumor of the uterus, and is perhaps the most common of the three. Growths of this kind are of a fleshy consistence, firm, yet compressible, smooth, elastic, of a pale greyish color, and composed of dense filaments, which are so intimately interwoven with each other as to render it impossible to unravel them. In their shape, they are commonly globular; sometimes pyriform; and in one instance, I found one that was of the figure of a mushroom, the rounded foot-stalk being attached to the neck of the uterus, the base projecting into the vagina. (Fig. 228.) The fibrous polype has few vessels and nerves; and it is therefore little liable to bleed or to be attended with pain. Tumors of this kind have often a very rough surface, and they sometimes contain considerable cavities filled with serum, jelly, pus, or earthy matter.

The *vascular* polype is composed essentially of vessels and cellular tissue, the fibrous element being either entirely wanting, or existing only in a very limited degree. This species is extremely rare, and seldom attains a large size; it is of a red, florid color, of a soft spongy consistence, sensitive on pressure, erectile, and exceedingly prone to hemorrhage. In respect to shape, it presents the same diversities as the other species.

The *vesicular*, *cellular*, or *gelatinoid* polype holds a sort of intermediate rank between the two preceding, being softer than the fibrous and harder than the vascular. This species is readily distinguished by the following characters: It is semi-transparent, of a peculiar greyish complexion, compressible, glistening on the surface, and attached by a delicate pedicle, which renders it pendulous. If it be carefully examined, after it is removed from the body, it will be found to exhibit a shreddy, tremulous structure, interspersed with a few vessels, which are generally too small to emit much blood. The gelatinoid polype is sometimes quite large, but on the whole may be considered as infrequent. It seems to be much under the influence of atmospheric pressure, increasing in size when the weather is moist, and diminishing when it is dry.

The fourth variety of uterine polype is the *granular*, which consists in an enlargement of one or more of the mucous follicles, situated at the mouth of the womb, and described by the older writers under the name of the ovules of Naboth. It is rarely solitary, but almost always occurs in clusters, of a whitish or greyish color, commonly about the size of currants or grapes, suspended by long, slender pedicles, and strongly resembling, in general appearance, the surface of a cauliflower. When there is only one such tumor it may attain the volume of a walnut, or even of a hen's egg. It is invested by a smooth, delicate, vascular membrane, possesses little sensibility, and often contains a yellowish curdy matter, which is probably nothing but inspissated mucus. The connexion with the uterus is very slight, and its growth generally very tardy. When

Fig. 228.





bulky or of long standing it may cause great irritation, and give rise to copious sanguineous and mucous discharges from the vagina.\*

Such are the distinctive characters of the four species of uterine polypes now described. To these it will be necessary to add a few remarks respecting certain features which they possess in common with each other.

Uterine polypes are found of all sizes, from that of a bean up to that of a gourd. Fig. 229 represents a small tumor of this kind, of a pear shape, lobulated, and attached to the base of the womb by its foot-stalk. Their volume, in some cases, is immense. Dupuytren saw one which weighed twenty-five pounds; and another, described by De Claubry, weighed thirty-nine pounds, and was nearly three feet in its vertical circumference. They occasionally extend far down into the vagina, and cases have been witnessed in which they reached more than ten inches below the vulva. (Fig. 230.) The shape of these

Fig. 229.

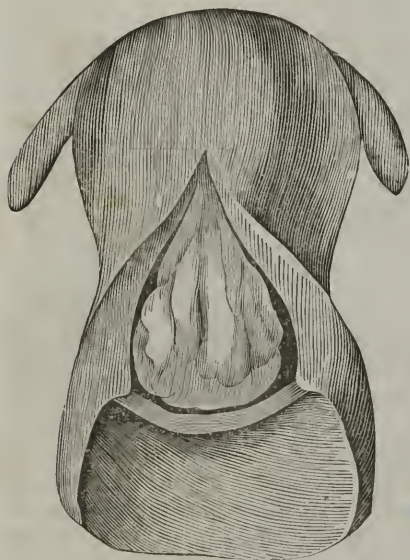
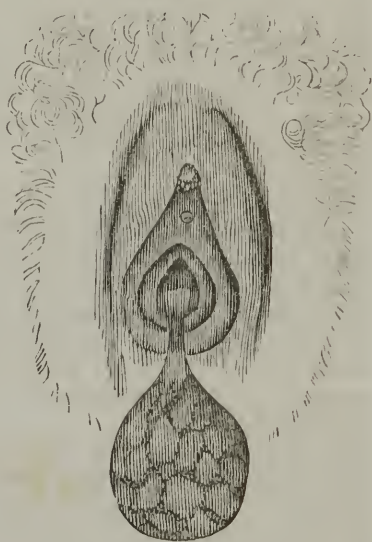


Fig. 230.



morbid growths is mostly pear-like; and, although they may originate in any portion of the cavity of the uterus, they are most frequently attached to its neck. Many of them have a narrow, slender peduncle; and, in such as are of great size, it is not uncommon to see deep fissures, which give them a lobulated arrangement. Each of the three species that we have described is invested by a thin mucous membrane, which is more or less vascular, and merely a prolongation of that of the womb, immediately beneath which the morbid growth is developed.

Uterine polypes often contain large cavities, filled with substances that are not natural to them. Earthy concretions have been found in their interior, and some have pretended that they have detected tubercular matter. Waller alludes to cases in which they contained hair. These tumors are most common in aged females. A notion, but a very erroneous one, was formerly entertained that they occurred most frequently in old maids. On this subject the observations of Dupuytren are not only instructive, but decisive. Of fifty-

\* Lee, *Medico-Chir. Trans. of London*, vol. xix., p. 128.

eight women affected with polypes, all were married except four, who were single, and supposed not to have had sexual intercourse. Nearly all of them had borne children.\* Their presence often occasions alarming hemorrhage; and, when they become ulcerated, they may give rise to a copious discharge of irritating and offensive matter.

*Calculus concretions* sometimes occur in the uterus. Of these formations many cases are described by the older writers, and not a few by those of a more modern date. One of the most interesting examples, perhaps, on record, is that related by the celebrated Louis, in the *Memoirs of the Royal Academy of Surgery of Paris*.† It was observed in an old female, who was affected for a long time with difficulty in voiding her urine, and severe pain in the loins and perinæum. The uterus, which was in a state of scirrhus, and of extraordinary size, contained a hard, compact, and irregularly-shaped concretion of a bony structure, which weighed five ounces and a half. Generally, however, these heterologous formations are much smaller, not exceeding the volume of a grape, a pigeon's egg, or a walnut. Most of them are of a light greyish color, of an osteo-cretaceous character, and somewhat lamellated, with a rough unequal surface. It would seem, from the researches of the late Professor Turner, of London, that these bodies essentially consist of carbonate of lime, in union with a little animal matter.

Concretions of this sort are sometimes surrounded by a delicate membrane provided with minute vessels, and not unfrequently they contain small nodules of cartilage. Although their most usual situation is the cavity of the organ, yet they are occasionally developed in its substance, beneath its serous investment, or even in the uterine veins. Violent pain in the pelvic region, more or less uneasiness in the back and perinæum, and bearing down efforts similar to those of labor, are the principal symptoms marking the presence of these abnormal formations. When seated in the proper cavity of the womb, nature sometimes makes an attempt to expel them, which is almost always attended with considerable hemorrhage. At other times, though very rarely, their presence excites ulcerative absorption, leading to great local suffering and the formation of fistulous tracks between the uterus and the adjacent viscera. Calculous concretions are most commonly observed in advanced life; but in a few instances they have been witnessed in young females, married as well as single, soon after the establishment of the menstrual function. Indeed, there is a case recorded in one of the early volumes of the *German Ephemerides*, in which a body of this kind is stated to have been developed in the uterus of a girl five years of age: it was of a pale yellowish color, and a little larger than a pigeon's egg.

How these concretions are developed is still a litigated question. I have already described the formation of similar bodies in the plastic lymph of the serous membranes of the joints and of the visceral cavities; and it is not improbable that those under consideration have an analogous origin. It is well known that the uterus is liable, at all periods of life, but especially in old females, to the effusion of fibrin, either into its cavity, into its substance, or into the submucous cellular tissue. In either case, the fluid, if it be permitted to remain, becomes organized, and converted ultimately into an adventitious structure of a fibrous, fibro-cartilaginous, cartilaginous, or osseous character. It is possible that they may also be produced by the presence of coagula, formed during uterine hemorrhage; and it is probable, likewise, that in some rare instances

\* *Leçons Orales*, t. iii., p. 485. Paris, 1832.

† *T. ii.*, 4to. edit. 1769.

the earthy matter is poured out without being preceded by any new growth, whether of an analogous or heterologous nature. This hypothesis derives support from the fact that these concretions are occasionally found entirely disconnected from the substance of the womb, lying perfectly loose in its cavity, or upon its outer surface.

The uterine tissue may be partially *transformed* into cartilage, bone, or earthy matter. The foreign substance is generally seated in the proper texture of the organ, but occasionally it is lodged in the submucous cellular tissue, and appears to be encysted. Examples of this description are recorded by Baillie, Littson, Meckel, Bouvet, and other authors. Louis, in his excellent Essay on Calculous Concretions previously alluded to, quotes an instance in which the parietes of the uterus were so completely ossified as to require to be broken with a hammer: the organ was of enormous size, and contained a considerable quantity of thick purulent matter. In another case, referred to by the same distinguished writer, the internal surface of the womb was studied with numerous projections, of a yellowish color, and a firm, rock-like consistence, bearing a striking resemblance to stalactites. "I have seen a uterus," says Dr. Hooper,\* "the size of an adult head, irregular on its surface, and formed wholly of hard bony matter, surrounded by the expanded fibres of the organ, and in many parts covered only by the peritonæum." Such transformations are, however, extremely rare. They occur almost exclusively in females past the age of forty-five, and they appear to be produced by a perverted action of the uterine vessels, caused probably by chronic irritation. It would be interesting to ascertain, if this could be done, how far these deposits are connected with similar lesions of the arterial system.

The womb is often the subject of *malignant disease*, described by authors under the several denominations of scirrhus, fungus hæmatodes, cauliflower excrescence, corroding ulcer, and carcinoma. Scarcely any one of these appellations seems to me to be well chosen, as they have reference rather to certain states or appearances of the parts than to their true nature and constant anatomical characters. Not unfrequently all the conditions expressed by these terms are blended together, and even when they exist separately they have invariably the same tendency, namely, that of destroying the different textures of the uterus and the adjacent viscera.

Malignant disease, be its nature what it may, generally begins at the neck and lips of the organ, from which it gradually ascends to the other parts. So common is this mode of attack that it was once supposed to be invariable in its occurrence. Recent observations, however, made by some of the most able pathologists of Europe, prove that there are numerous exceptions to this rule, and that in many cases the disease, instead of showing itself first in the parts just mentioned, commences at the base or body of the organ, thence spreading downwards so as to manifest itself last in its inferior extremity.

The mouth of the womb in this affection usually becomes hard, thick, and irregular, and the lips are everted, and painful on pressure, bleeding not unfrequently on the slightest touch. One of the earliest symptoms is hemorrhage, not slight, but severe, and long-continued. Of twenty-one cases collected by Louis at the Charity Hospital in Paris, sixteen commenced in this way; and of six observed in the wards of the same institution by the late Dr. James Jackson, Jr., of Boston, five began in a similar manner. Both these writers lay great stress upon this phenomenon, considering it of more diagnostic value in the inceptive stage of the complaint than any other hitherto pointed out.† The pain accompanying this disease is variable, being at

\* Morbid Anatomy of the Human Uterus, p. 14. London, 1832.

† Memoir of James Jackson, Jr., M. D., p. 116. Boston, 1835.



one time severe, at another so slight as almost to escape notice.\* After this state has continued for some time, ulceration takes place, a thin, sanious fluid, abundant in quantity and highly irritating in quality, oozes from the vagina, and all the textures of the affected part are completely destroyed. The base and body of the uterus, which are often much enlarged, also change their appearance; they become hard and firm, like fibro-cartilage, and are intersected by dense, greyish filaments running in a radiating direction. In some instances, the organ, when cut, has a raw flesh-colored aspect, like a slice of fresh pork; this is called the *lardaceous* degeneration of the uterus. In other cases, it has a *gelatinous* structure; and, in a third variety, as the softening and ulceration proceed, it assumes the color and consistence of *encephaloid*.

The brain-like variety of the disease generally occurs in the form of soft, lobulated masses, the interior of which contains clots of fibrin, varying in color and consistence, according to the length of time they have been deposited. Their size seldom exceeds that of an orange, but sometimes they are as large as a fetal head, of an irregularly globular figure, and of a dark brownish complexion, caused by the secretion of melanotic matter. In other cases, again, though these are rare, the internal structure is of a deep red color, and composed essentially of anastomosing vessels.

As the disease progresses, various morbid growths spring from the ulcerated surface, and fill up the vagina. These at length fall off by sloughing, and are either speedily succeeded by others, or they leave a deep excavated sore, with hard, irregular edges. In this stage of the complaint, there are generally copious discharges from the vagina, consisting of a thin, corroding sanies, serum, pus, or sero-purulent matter. In many individuals such discharges are exceedingly fetid, and at once serve to point out the true nature of the lesion.

Carcinoma of the uterus is most common about the decline of the menses, in married females that have borne children. Of twenty-two cases of this disease recently reported by Dr. Ashwell, of London,† eight occurred between thirty and forty; six between forty and fifty; six between fifty and sixty; and two between sixty and seventy. All the women were married, and, except two, had been mothers; seven were of light complexion and fifteen dark.

In four hundred and nine cases of cancer of the uterus, examined by Madame Boivin and Professor Dugès,‡ the period of life was as follows:

Under twenty years of age	-	-	-	-	12
From twenty to thirty	-	-	-	-	83
From thirty to forty	-	-	-	-	102
From forty to forty-five	-	-	-	-	106
From forty-five to fifty	-	-	-	-	95
From fifty to sixty	-	-	-	-	7
From sixty to seventy	-	-	-	-	4

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Thus it would seem that nearly as many patients die between the ages of forty and fifty as in all the other periods of life conjoined. Before the twentieth, and after the fiftieth year, the disease is very infrequent; owing, doubtless, to the want of activity of the uterine organs.

\* "Authors generally describe this disease as attended with excessively severe pains, &c. This is sometimes true, but by no means so generally as has been thought. Of the six cases now in our wards — Charity Hospital — in three there was no pain until a very advanced period; and then it was inconsiderable; and in one, although the disease is quite advanced, there has as yet been no suffering." Jackson, *Op. cit.*, p. 117.

† Guy's Hospital Reports, No. 4, April, 1837.

‡ Practical Treatise on Diseases of the Uterus, translated by Hemiug, p. 231.

Of one hundred and twenty cases, reported by Mr. J. C. W. Lever, of London,\* the ages of the patients were as follows:

Between 25 and 30 years		-	3.3 per cent.
30	35	„	15. „
35	40	„	10.83 „
40	45	„	20. „
45	50	„	20. „
50	55	„	13.3 „
55	60	„	14.16 „
60	65	„	0.83 „
65	70	„	1.6 „
70	75	„	0.83 „

The single women, in these cases, bore a proportion of 5.83 per cent., the married females 86.6 per cent., and the widows 7.5 per cent.; affording thus, as far as they go, a complete refutation of the opinion, entertained by so many practitioners, that celibacy favors the development of carcinoma of the uterus.

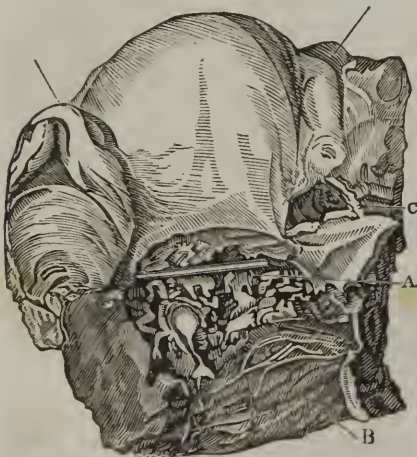
Of the 113 married women, 10 had borne no children. Of the whole number only twenty-five, or 20.8 per cent., had enjoyed good uterine health in early life, while ninety-five, or 79.16 per cent. had suffered either from functional disease or syphilis. The most common malady was dysmenorrhœa, with which not less than sixty-six had been afflicted. The number of light complexioned patients amounted to 20.8 per cent., of dark complexioned to 79.16 per cent.

Of the above women one hundred and seven died, at an average period of twenty months and a quarter from the invasion of the malady. The shortest duration was three months, the longest five years and a half. Marriage and the previous state of the health do not appear to have exercised any particular influence upon the progress of the disease.

“There is a variety of malignant disease of the uterus, which some have considered as essentially different from the preceding, but which is a mere modification of the varieties already described. It has been called the *phagedænic* or *corroding ulcer* (Fig. 231) of the womb. Sometimes the ulcer, which

is of a deep violet color, is quite superficial, without much thickening, induration, or enlargement of the part. The ulcer begins, like any other malignant ulcer, on the surface of the body, and gradually proceeds until the greater portion of the neck of the uterus has been destroyed, or removed by ulcerative absorption, and openings are formed into the bladder and rectum. The portion of uterus which remains after death is sometimes not much altered in appearance; more frequently, however, it becomes softened in texture, and assumes a yellow or reddish brown color.”† This affection, so destructive in its consequences, rarely if ever occurs before the age of forty, and commonly not until that of fifty or sixty.

Fig. 231.



a, corroding ulcer; b, vagina; c, uterus.

\* Medico-Chir. Transactions of London, vol. xxii., p. 277.

† Cyclopædia of Practical Medicine, article *Uterus*, p. 344.

Soft *fungous excrescences* (Figs. 232, 233,) of a cauliflower shape, also sometimes grow from the mouth of the uterus, and undergo changes similar to those observed in other varieties of malignant disease. These morbid structures, first accurately described, I believe, by the late Dr. John Clarke, of London, have a rough, granulated surface, and in most cases are of a bright flesh color: they are of a soft erectile texture, extremely vascular, and very liable to bleed when injured. In their size, they vary from that of a hen's egg to that of a large fist; their growth is often quite rapid, and, when the vagina is very dilatable, as in women who have borne many children, they sometimes protrude beyond the lips of the vulva. Excrescences of this sort do not appear to be endowed with much sensibility, and hence the patient seldom complains when pressure is made on them. They *invariably* spring from the mouth of the uterus, *never* from any other part; and it is pretty generally admitted now by all pathological anatomists that they have always a malignant tendency, destroying life either by constitutional irritation, or by the exhaustion produced by the profuse sero-sanguinolent discharges. Dr. Dewees\* states that he has never met with this disease, and I therefore conclude that it is extremely rare in this country. I have seen only one specimen of it, which is preserved in our college museum.

*Tubercular matter*, such as we find in the lungs, seldom occurs in the uterus, and perhaps never before the age of puberty. It is usually deposited upon the inner surface of the organ, which is sometimes entirely incrustated with it, forming a layer of half an inch or more in thickness. Bayle and Laennec make no mention of this disease; Andral, though he indicates its existence, offers no cases of it; Louis met with it only once; and Regnaud saw only three examples of it during a residence of six years in one of the largest Parisian hospitals. In one of his cases the malady was associated with tubercles of the lungs. The female had menstruated, and borne children. In some instances, though this, I believe, is very rare, the matter is deposited into the substance of the womb, or into the cellular texture between it and the peritonæum. In my own dissections I have never met with this disease.

Fig. 232.



a, excrescence; b, os uteri; c c, ovaries; d, body of the uterus \*

Fig. 233.



\* Treatise on the Diseases of Females, p. 296. Philadelphia, 1837.

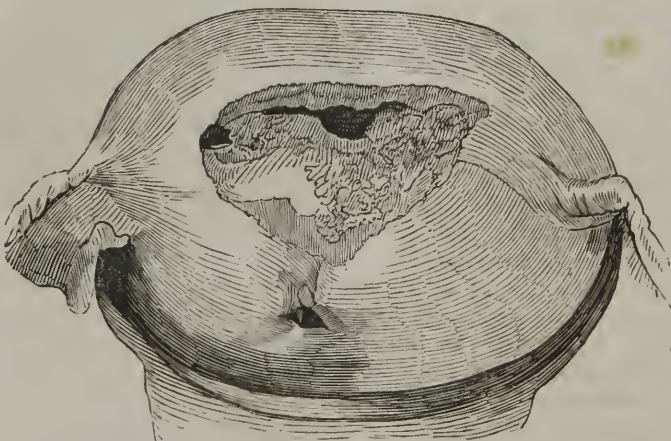


The uterus, like other hollow viscera, as the heart, stomach, and urinary bladder, is liable to *laceration*, both in the unimpregnated and in the gravid state. The causes which predispose to this accident are wounds, such as are made in the Cæsarian section, softening of the uterine tissue, irregular contractions, and various organic degenerations, which, although they may increase the thickness of the parietes of the womb, render them more brittle, and thus diminish their power of resistance. The rupture, which may be partial or complete, transverse, oblique, or longitudinal, is most frequent during parturition, within twelve or fifteen hours after the commencement of labor, and almost always affects the neck and lower segment of the organ, very rarely the fundus or upper part.

Of two hundred and thirty well authenticated cases of this lesion, related by Dr. Nevermann,\* in his German translation of Duparcque's "*Histoire Complète des Ruptures et des Déchirures de l'Uterus, du Vagin, et du Périnée.*" Sixty-two occurred during pregnancy, and one hundred and sixty-eight during labor. "Of the latter, eighty affected the body of the uterus, nine running in a transverse direction, and sixty-eight longitudinally, and extending backwards and to one side: in three cases the fundus was perforated partly by the feet of the child, partly by previous ulceration, and in one instance only the fundus was rent. In thirty-six cases the neck was torn longitudinally, and in fifteen transversely. In four cases the uterus was torn away from the vagina, and in twenty there was merely a small perforation of the body or neck. In the other cases the seat of the rupture is not mentioned."

"The rupture does not always extend through the whole of the substance of the uterus. In four cases the peritonæum only was torn, and in five cases the uterus was torn and the peritonæum uninjured; and, in all these apparently slight cases, death ensued. The size of the lacerations varies much; some have been seen only a quarter or half an inch in length, others nine inches long, or even involving two-thirds of the uterus. Sometimes the rupture is merely a small, round hole, through which fatal hemorrhage takes place; thus, in a patient of Dr. Collins, who died of sudden hemorrhage on

Fig. 231.



the fifth day after delivery, a piece of the muscular substance of the uterus, about the size of a shilling, corresponding to the projection of the sacrum, was

\* See Brit. and Foreign Med. Rev., vol. x., p. 493

found to have given away, the peritonæal covering remaining uninjured." Fig. 234 is a laceration of the fundus of the uterus, from a specimen in the collection of the Institute.

All obstetricians bear witness to the rarity of this accident in first labors. Of eighty-three cases recorded by Collins, Robertson, and McKeever, ten only occurred under these circumstances. Dr. Nevermann,\* the writer above alluded to, finds, on a comparison of 406,081 labors, that the uterus was ruptured eighty-five times, or in the proportion of 1 to 4777.

Of *hemorrhage* of the uterus we shall speak only as it affects the organ in the unimpregnated state. Contemplating it under this restriction, the occurrence is most common in married females, about the cessation of the menstrual function, and is observed in every state of constitution, in the strong and plethoric, as well as in the feeble and relaxed. A great variety of causes have been enumerated as giving rise to uterine hemorrhage; but the most frequent by far is that peculiar state of the system which accompanies the disparition of the menses, together with ulceration of the mouth of the womb, or the presence of some adventitious growth. Disease of the ovary also powerfully predisposes to this lesion; and there are some females who are naturally, or from habit, so prone to it, that the most trifling exertion is sufficient to bring on an attack. The duration of the hemorrhage varies from a few days to several weeks. When dependent upon structural disease, or the presence of a polypous tumor, the blood often comes away suddenly, in a gush, which continues for a few hours, and then ceases.

The effused blood is generally of a dark red color, and comes away in coagulated masses, though occasionally, especially when the hemorrhage is sudden and profuse, it is of a fluid consistence, as well as of a lighter tint. With regard to the quantity of blood lost, it may vary from a few ounces to several quarts; and, although it is generally greatest when it proceeds from a ruptured vessel, it is often not less abundant when it has its source in exhalation of the mucous membrane. On dissection, we find the surface of the womb either of a uniform red color, or mottled with blackish spots, soft and corrugated, with here and there a submucous ecchymosis. The whole organ is commonly somewhat relaxed, and, on cutting through its substance, small clots of blood are occasionally observed, resembling apoplectic effusions of the brain.

Large quantities of *water* have been known to accumulate in the cavity of the womb, — ten, fifteen, and even twenty quarts. The affection, however, is extremely rare, and is always connected with a closure of the mouth of the organ, caused by previous inflammation, malignant disease, or some morbid growth. The fluid is generally clear and limpid like the serum of the blood, which it also resembles in its chemical properties. In some cases it is thick and turbid; and it has also been found of the color and consistence of coffee-grounds, from the admixture, probably, of sanguineous matter. The tumors thus formed often simulate pregnancy, are painful on pressure, and slightly fluctuate under the fingers. The disease, which is technically called *hygrometra*, is occasionally connected with utero-gestation, of which it forms one of the most distressing complications. Its true pathology is still involved in obscurity. In all probability, it is dependent upon chronic inflammation of the lining membrane of the womb, and the transformation of this membrane into a serous structure.

\* Brit. and Foreign Med. Rev., vol. x., p. 493.

*Air* now and then collects within this viscus, constituting the disease which has been described by pathologists under the name of emphysema, physometra, and tympanites. How this is formed is still a litigated point. In many cases, it can be traced to the decomposition of effused fluids, such as blood, serum, or pus; in others, it is not unlikely that it is the product of a true secretion from the uterine vessels, brought about by some morbid condition, the precise nature of which is unknown. These accumulations may take place at any period of life, in the married and single, in the young and the old. When considerable, they cause the womb to expand and rise up in the abdomen, as in pregnancy, with which it may be easily confounded. After the flatus has existed for several months, the uterus commonly makes an effort to dislodge it, expelling it with a noise somewhat similar to what is occasioned in eructation.

The uterus may contain *hairs*. Of this, Fabricius Hildanus and Vicq d'Azyr,\* each mention examples. Sæmmering, in his edition of Baillie's Morbid Anatomy, alludes to a uterus, preserved in the collection of the Academy of Copenhagen, which contains a number of hairs. Blancardi,† mentions an instance in which this organ was filled with an enormous quantity of water, including a fatty-oleaginous mass, in which a number of hairs were rolled up. A case in which a mass of hair was expelled from the uterus was lately reported by Dr. Henry R. Frost,‡ of Charleston, South Carolina. The patient was a colored woman, twenty-five years of age, healthy, robust, and pregnant with her first child. Two months after her delivery, a mass of hair was extracted from the vagina, five inches in length by an inch and a half in diameter at the largest part, of an irregularly pyriform shape, highly offensive, saturated with purulent matter, and looking like wet tow. The individual filaments were from one to two inches long.

The *mouth* of the uterus is sometimes preternaturally small, or so much contracted as scarcely to admit a silver probe, or even a hog's bristle. This lesion is often congenital, but in other cases it is brought about by inflammatory irritation, in the same manner as stricture of the urethra. The late Dr. Mackintosh, of Edinburgh, thought that this condition of the uterine orifice was a frequent cause of dysmenorrhœa; and the cases which he has adduced, in illustration of the subject, tend very much to favor his conclusion. As yet no opportunity has presented itself to me for verifying the results of the Scotch pathologist, nor am I aware that this has been done by others.

We sometimes find *hydatids* in the uterus, though not so frequently, perhaps, as has been generally imagined by the profession. This subject, notwithstanding the great number of physicians who have written upon it, was first fully noticed by Madame Boivin, of Paris. In her celebrated *Mémoire "Sur l'Origine, la Nature et le Traitement de la Mole Vésiculaire ou Grossesse Hydatique,"* published in 1827, she developed the leading facts, and has left scarcely any thing else to future observers, than to verify and strengthen her inferences.

The number of uterine hydatids is often immense. In a specimen in my collection, notwithstanding a great many were lost during the delivery, there are at least ten thousand, of all sizes between an almond and a mustard-seed.§

\* Mém. de l'Académie des Sciences, 1776.

† Voigtel's Handb. Path. Anat., B. 3, s. p. 515.

‡ West. Jour. Med. and Surgery, vol. vi., p. 217.

§ I am indebted for highly interesting specimens of these parasites, to my friends, Dr. Joshua Martin, of Xenia; Dr. M. Dunlap, of Greenfield; and Dr. Thompson, of Columbus, in the State of Ohio.



(Fig. 235.) In their shape, these bodies are either globular, pear-like, or conoidal; and they are usually strung together by an intricate plexus of pedicles, which ramify in every direction, and are frequently not thicker than a common sewing-thread. The length of these stems varies from a few lines or less to several inches; they are of an irregularly, cylindrical figure, and from two to six are occasionally attached to the same vesicle; their strength is always very slight, so that they break with great ease; and many of them, though not all, are distinctly tubulated, being inflatable from the hydatids with which they are associated. The canal, however, does not generally extend through the whole length of the foot-stalk, but only a comparatively short distance, seldom more, indeed, than six lines or an inch.

The larger hydatids have generally smaller ones attached to different parts of their surface, — an arrangement not unlike what is observed in some tuberous roots. From five to ten, not bigger than a grain of barley, are often seen sprouting out in this way, their connection with the parent parasite being effected by means of a narrow, delicate stem, scarcely half a line in length. But, whatever may be their size or form, they all adhere, immediately or indirectly, to one common stalk, exactly like a bunch of grapes, and which consists either of a portion of degenerated placenta, a fibrinous concretion, somewhat similar to an ordinary mole, a blighted ovum, or the remnants of the fetal envelopes. These are, I conceive, highly important circumstances in the history of these singular productions, inasmuch as they fully confirm the opinion, so warmly advocated by many writers, but so strenuously denied by others, that hydatids are never found except as the result of impregnation.

When carefully examined, each vesicle is found to have three distinct coverings, which may generally be separated without much difficulty with the knife, care being taken to hold the morbid growth under water: the external tunic is extremely delicate, almost like a film, and of a pale cineritious color, which becomes more perceptible when it is detached from the subjacent layer; it is easily lacerated, semi-transparent, and may be considered as a sort of deciduous membrane. The second lamella, on the contrary, is

Fig. 235.



comparatively thick, firm, dense, and resisting; it has a whitish appearance, possesses the property, in some respects, of a fibrous texture, and serves at once to give shape and consistence to the vesicle which it assists in forming. Within the two coverings now described lies the hydatid, properly so called, which is generally so weak as to break under the pressure of the atmosphere, and which appears to consist merely of a thin, lymph-like sac, filled with serous fluid. In the recent state, this lamella is perfectly smooth and transparent; but, by immersion in alcohol, it speedily becomes opaque and corrugated. In most cases the parasite lies loosely within its envelopes, but occasionally, especially when the vesicles are old or of large size, there is a pretty strong adhesion, by means of thread-like filaments, between them. Its contents are clear and limpid, like the purest spring water, slightly saline to the taste, and partially coagulable by heat, proof-spirit, and dilute acid.

It has been already seen that the number of these bodies is sometimes extremely great. By their agglomeration large masses are formed, the weight of which has been known to exceed ten pounds, though ordinarily it is considerably less. These masses are generally expelled piecemeal, and they are rarely if ever enveloped by distinct fetal membranes, unless there are at the same time remnants of a blighted ovum.

The period of hydatid gestation, as might be supposed, is extremely variable. The following table, compiled from Madame Boivin, and other writers, gives an accurate view of the duration of this disease in forty-four cases, including five that have been communicated to me by medical friends.

Duration of the Disease.								Number of cases.
3 months	-	-	-	-	-	-	-	4
4 "	-	-	-	-	-	-	-	3
5 "	-	-	-	-	-	-	-	3
6 "	-	-	-	-	-	-	-	5
7 "	-	-	-	-	-	-	-	6
8 "	-	-	-	-	-	-	-	7
9 "	-	-	-	-	-	-	-	10
10 "	-	-	-	-	-	-	-	3
11 "	-	-	-	-	-	-	-	1
13 "	-	-	-	-	-	-	-	1
14 "	-	-	-	-	-	-	-	1

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From this table it appears that the number of hydatid births, if so they may be styled, is, within a fraction, twice as great after the sixth month as anterior to that period. Never, so far as my knowledge extends, does delivery occur before the expiration of the third month. The mean duration of this species of pregnancy, calculated from the above cases, is a little more than seven months, provided we receive as correct — which I am disposed to think we should not — the examples of Baudelocque, Vernois, and others, where the female is said to have carried the morbid product more than a year.

It has been supposed that hydatids of the uterus are most common in women about the decline of the menses; but this opinion is evidently grounded upon superficial observation. Of thirty-one cases, in which the age is satisfactorily stated, I find that twelve occurred between the twentieth and thirtieth year: eight between the thirtieth and fortieth; and eleven between the fortieth and fiftieth, or rather between the fortieth and forty-sixth, for beyond this period I am not acquainted with a single well-authenticated instance in which this degeneration was observed.

The development of these parasites is generally, if not invariably, preceded by one or more normal gestations. In a case, the particulars of which were recently communicated to me by my friend, Dr. Dunlap, of Greenfield, in the State of Ohio, the woman, who was forty-six years old, and had always been in the enjoyment of excellent health, had given birth to eleven children. Occasionally these bodies form in several successive pregnancies; and, in a few rare instances, they have been observed in several members of the same family.

The expulsion of the hydatids is almost constantly attended with more or less hemorrhage. To this statement, indeed, there are few exceptions. A discharge of blood frequently takes place at a very early period of gestation, and recurs at variable but generally short intervals, until the time of parturition. The quantity of blood lost is often very great, so much so as seriously to undermine the vital powers, or even destroy the patient. Of this unhappy termination, instances are recorded by several writers, amongst others by Pechlin, Home, and Moth. The expulsion of these bodies is always accompanied by labor pains.

The symptoms produced by the presence of uterine hydatids are such as occur in ordinary pregnancy, — that is to say, with suppression of the menses there is morning sickness, faintness, and capricious appetite, with gradual increase of the abdomen. If the morbid mass be retained until the eighth or ninth month, the breasts occasionally enlarge and secrete milk, as in normal gestation. The only sure sign of the existence of these bodies is a discharge of sero-sanguinolent fluid from the vagina, which may set in at a very early period, and is particularly abundant in the morning when the patient rises from her bed, or whenever she subjects herself to any severe bodily exertion. The abdominal tumor is also more soft and flaccid than in ordinary pregnancy, it falls more easily from one side to the other, and no placental sound is heard on the application of the stethoscope.

As to the causes of these morbid growths, they are enveloped in complete mystery. It has been conjectured by many that they are occasionally an original production of the uterus; but there is no case on record, so far as I remember, which warrants such a conclusion. Indeed, when we reflect upon the fact already adverted to, that they always occur in association with mole-like concretions, the membranes of a blighted ovum, or some remains of the fœtus itself, or finally, with portions of the placenta in a state of degeneration, it must be conceded that they are invariably the result of impregnation. If this view be adopted, it follows, as a natural deduction, that the development of the new being is arrested and another action set up, under the influence of which the bodies in question are created. What the nature of this action is, we cannot of course determine any more than that which presides over ordinary generation.

Many anatomists have imagined that these parasitic formations are mere watery vesicles, not genuine acephalocysts, as is the case with hydatids in other organs. That this is occasionally true is not improbable; but that they are really living animals, in the generality of instances, the concurrent testimony of the best writers on the subject abundantly proves. M. Hippolitus Cloquet has given them the name of racemose acephalocysts; and various naturalists regard them as hydatoid worms. Schroeger, a German author, considers them as varicosities of the lymphatic vessels of the placenta; Ruysch, as dilatations of the extremities of the arteries. The latter opinion has recently been revived, and warmly advocated by Cruveilhier. Such views, however, notwithstanding they possess some plausibility, are certainly altogether idle and unprofitable, as they have not a single fact to recommend them to our judgment.

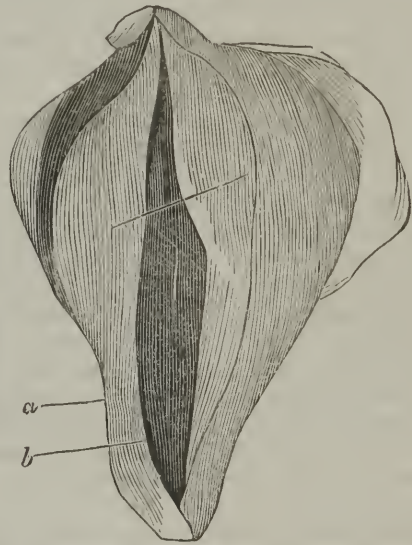


The last subject proposed to be discussed is that of *uterine moles*. Under this term authors have described different, and often very dissimilar products, which, after continuing for a variable period in the womb, are finally expelled with all the phenomena of ordinary labor. For the sake of perspicuity, so essential in all pathological inquiries, I shall at once proceed to divide uterine moles into two species, the fibrinous and the vascular. This arrangement, it will be perceived, altogether excludes uterine hydatids, which have been referred to this head by Madame Boivin, in the work before quoted, and which, from the many peculiarities they display, are worthy, I conceive, of separate consideration.

The *fibrinous mole* (Figs. 236, 237, 238) is a much more interesting and

Fig. 236.

Fig. 237.

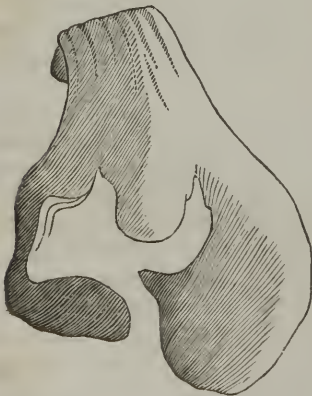


Exterior of a fibrinous mole.

Mole cut open, showing its structure; a, chorion; b, amnion.

intricate structure than we might be led to infer from the imperfect descriptions of it by authors. In its shape it is always, so far at least as reiterated inspection has enabled me to judge, more or less conical, pyriform, or gourd-like, never,

Fig. 238.



Mole with the cavity communicating externally.

I believe, perfectly globular. Occasionally, though this is rare, it is somewhat lobulated or angular, either externally or upon the inner surface, or in both these situations at the same time. Its size and weight vary very much in individual cases. In five specimens of this species of mole which I examined with great care along with Professor Parker, the mean weight was found to be a little more than one ounce, the maximum two ounces, the minimum six drachms. The length in the same cases varied from two inches and a half to three inches and a quarter; the width, from one inch and a half to two inches and a quarter; and the thickness, from one inch and a half to two inches. We are told by some writers, amongst others by Unezwolf, a German physician, of fibrinous moles that weighed nine pounds, and were as

large nearly as an adult head; but such examples must be exceedingly rare, and I have never met with them.

The fibrinous mole, in the recent state, has very much the appearance of a mass of blood, being of a modena color, not uniformly, but darker in some places than in others. It is of a firm, solid consistence, requires a good deal of force to cut it, and emits a dull, creaking sound under the knife, like fibro-cartilage. The degree of induration, however, is not the same in all cases, or even in all parts of the same specimen. When retained long, this species of mole sometimes partially degenerates into a hard, gristly substance, similar to certain transformations of the placenta.

Externally, the adventitious product is invested by a greyish, fragile lamella, generally not more than the fourth of a line in thickness. It evidently serves to connect the mole to the inner surface of the uterus, and possesses all the characters of the deciduous membrane. Not only does this lamella cover the exterior of this body, but it usually passes into the internal canal, which it thus lines throughout its whole extent. Hankoph\* has recorded an instance where the mole was surrounded by an osseous covering, which was formed, doubtless, by a degeneration of the structure here described.

On making a longitudinal section of this morbid growth, an internal cavity is found which is always remarkably small in proportion to the enclosing parietes. In most instances, it extends nearly from one extremity to the other, at the larger of which, much more frequently than at the smaller, it has an external opening. To this law, which may be regarded as a very important one, I have met with only a single exception in a considerable number of specimens. To attempt to describe the shape of the internal canal would be idle, so much does it vary in different cases. Irregularity is its distinguishing characteristic. Very frequently it presents itself in the form of a fissure; sometimes it is cylindrical, and at other times it is angular. Equally irregular is the outlet of this canal; whilst in some instances it is small and tolerably well-defined, in others, and these are by far the most common, it is large, grooved, or slit-like. Occasionally it closely resembles the mouth of the unimpregnated uterus.

But whatever may be the form and dimensions of the internal canal, or of its outlet, it is always lined with two short sacs, which, though intimately united, are perfectly separable by dissection, and which appear to correspond exactly to the natural envelopes of the fœtus. The outer layer is rough, flocculent, and loosely connected with the deciduous membrane, which, as was before stated, is always reflected into the mole when there is an open cavity; the inner, on the contrary, is perfectly smooth and glossy, like the serous tissue in other parts of the body, and generally, though not always, contains a small quantity of transparent fluid, similar in every respect to the amniotic liquor.

The parietes of the cavity which we have just described are always exceedingly irregular, and they vary in different parts of their extent from the twelfth of an inch to six or eight lines in thickness. Examined in reference to their structure, they are found to be composed principally, if not wholly, of the fibrin and coloring matter of the blood, cemented together by plastic lymph. On making a section of the mole in the direction of the long axis, the outer portion is observed to have an imperfectly lamellated arrangement, and also to be somewhat more compact than the internal parts, which are of a much darker complexion, homogeneous, much more friable, and almost entirely made up of coagulated blood. In some instances, the walls are essentially fibrous, the

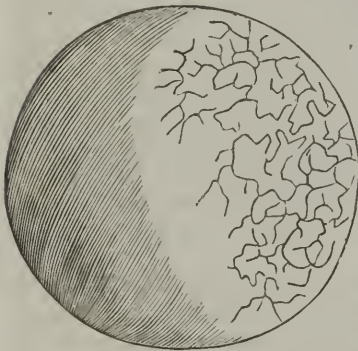
\* In Haller, Disp. Med., t. iv., p. 715.

fibres extending longitudinally from one extremity, or nearly so, to the other; they lie in close, parallel lines, are very coarse, easily torn, and separated from each other, and of a reddish-grey color, darker at some points than at others. These three varieties of structure are not unfrequently met with in the same tumor, the linear arrangement being seen at the apex, the lamellated at the external part of the body, and the uniform, homogeneous, or hematoid towards the centre.

The cellular tissue entering into the composition of this variety of mole is usually very small in quantity, and is often so intimately incorporated with the morbid mass as to be perceptible only after protracted maceration. Its vessels, which are generally quite large, may be seen ramifying over its outer surface, running, for the most part, in the direction of its long axis. They enter the new product at various points, but none can be traced beyond the depth of a few lines: they are sometimes quite varicose, their parietes are remarkably brittle, and they have altogether much more of a venous than of an arterial character. The anastomoses which exist between these vascular trunks are commonly very imperfect, — a circumstance which, with the delicacy of their structure, renders them exceedingly liable to congestion, rupture, and hemorrhage.

The second species of mole may be called the *vascular* (Fig. 239), in consideration of its structure, which, as the term imports, is essentially of that nature. It is much more rare than the preceding, but in what proportion it occurs we have no means to determine. In its shape, the vascular mole is generally globular, and, in its diameter, it varies from one to four inches. Its weight, after the discharge of its contents, ranges from three drachms to one ounce, according to its dimensions, or the thickness of its parietes.

Fig. 239.



In regard to its structure, this variety of mole may be said to bear a striking resemblance to the placenta. Like it, it appears to be essentially composed of bloodvessels, which freely anastomose with each other, and are bound together by delicate, cellular tissue, the whole forming a soft, spongy substance, the thickness of which rarely exceeds the sixth of an inch. In some instances, numerous intersecting filaments may be observed, which are either of a fibrous nature, or obliterated arterial and venous ramifications. Externally, the mole is incrustated with a thin, coriaceous lamella, which is much more delicate than in the fibrinous form: internally, it is furnished with two distinct membranes; the one answering to the chorion, the other to the amnion. They are much more perfectly developed than in the preceding variety, as well as more easily separable from each other; and the latter always encloses a considerable quantity, occasionally as much as three or four ounces, of watery fluid.

Such is a brief account of the two species of uterine moles. The period during which they are retained in the womb is of course liable to some variation, but in the generality of cases it does not exceed three months. In a few instances I have known them to come away as early as the end of the tenth week, and on one occasion as late as the middle term of normal gestation. Their expulsion is invariably accompanied, as far as my experience goes, with



more or less hemorrhage. The parturient efforts are usually very feeble, and often occupy from two to three days. The flow of blood may be so profuse as to endanger life. De Lamotte has recorded a case where it proved fatal.

The fibrinous mole has occasionally been observed in company with a healthy or diseased fœtus; and I have a specimen of the vascular variety, in the interior of which are the remains of an umbilical cord. Like hydatids, these products may occur in several successive pregnancies; and they have been noticed at all periods, from the age of puberty to the decline of the menses. Their development is commonly attended with the phenomena of ordinary gestation.

It is supposed by many that these bodies are never formed except as the consequence of conception, — an opinion which is in perfect accordance with the result of my own observations. I speak now, of course, of what I consider to be the true genuine mole; that is to say, *an organized body of a certain or determinate form and structure, having an internal cavity, either closed or open, and lined by two distinct membranes of the character already ascribed to them.* Such a product, no matter whether it be fibrinous or vascular, I do not hesitate to say, on the authority of considerable experience, is never developed in the virgin uterus. I have never seen an example of what some have called a *spurious mole* — a dense, compact, and amorphous mass, composed essentially of clotted blood — but such a substance might form, there is reason to believe, in females during the period which intervenes between the establishment and the decline of the menses, without intercourse or the stimulus of conception, simply from the effusion and retention of a small quantity of sanguineous fluid.

Of the causes under the influence of which the true mole is developed, nothing is known with any degree of certainty. We may suppose, however, in the absence of positive facts, that the uterus, instead of providing for the growth and nourishment of the new being, as nature has designed it should, takes on inflammatory irritation, which is followed by the destruction of the germ, the effusion of blood, and the formation of an abnormal structure, which, as we have already seen, is sooner or later detached and expelled.

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## SECTION II.

### OF THE OVARIES.

The ovaries are two small oblong bodies, lying in the upper part, of the broad ligaments, behind and somewhat beneath the Fallopian tubes. Their color is of a light greyish, and their volume nearly equals that of a common almond. With regard to the weight of these organs, much diversity obtains in the different periods of life, as well in the single as in the married state. In eight young females, who died between the ages of seventeen and twenty-three, and in whom, from their previous health and moral habits, there was every reason to believe that the ovaries were perfectly natural, I found the mean weight to be one drachm and a quarter, the maximum one drachm two scruples and a half, and the minimum fifty-six grains. With regard to their dimensions, the mean length of the organs, measured in the same subjects, was seventeen lines, the breadth nine lines, and the thickness four lines and a half. In women who have borne children, the ovaries are generally about half a drachm heavier, and they are also broader and thicker, but seldom any larger.

They are remarkably large in children : from the eighth to the twelfth year, they undergo little change in respect to their volume ; but, from this period on, they gradually augment in size, and at puberty they present the weight and dimensions here assigned to them.

Connected to the uterus by means of a thin, rounded, fibrous cord, scarcely an inch and a half in length, each ovary is invested by two tunics, which, although intimately united, differ from each other materially in their structure. Of these the outer is derived from the peritonæum, and is consequently of a serous nature ; the other is of a dense greyish membrane, of a fibrous texture, perfectly similar to the corresponding substance in the male, and denominated the *albugineous coat*. This coat, which gives shape and consistence to the ovaries, sends numerous processes, finer than the most delicate threads, through their proper parenchymatous structure, which they thus intersect in every possible direction.

Concerning the precise nature of the parenchymatous structure of the ovaries, the present state of our knowledge is such as not to enable us to communicate any positive information. All that is known, with any degree of certainty, is, that it is of a soft spongy consistence, highly vascular, succulent, and of a light rosaceous color. Their properties are particularly well-marked in females from the age of puberty until thirty-five, but they are much less conspicuous before and after these periods. Situated in this substance are the *ovarian vesicles*, or, as they are often termed, from the anatomist who first accurately described them, the *ovules* of De Graaf. Their number is from five to fifteen ; they are usually of a spherical shape, and in a specimen which I recently examined along with my friend Professor Parker, they varied in size from three-quarters of a line to two lines and a half. The largest are almost always seated superficially, just beneath the coverings of the organ, which they often elevate, like so many little pearls. The structure of these vesicles is much more intricate, I apprehend, than is generally imagined by anatomists. From a considerable number of dissections, some of which were witnessed by the gentleman just named, I am convinced that each consists of two membranes lying in close juxtaposition but perfectly distinct from each other. What their precise nature is, I am unable to specify, but am disposed to believe that the outer is fibrous, the inner serous. The first is of a pale greyish color, much thinner than the other, and pretty firmly adherent to the surrounding parenchyma ; the latter, on the contrary, is strong, thick, dense, and quite transparent in the normal state, but is rendered opaque on being immersed in alcohol and boiling water. This internal layer is sometimes arranged in the form of a double sac, by a sort of midriff or partition. Its office evidently is to secrete the humor which distends the Graafian vesicles, and which, as is shown by its ready coagulability on exposure to heat, proof-spirits, or any of the mineral acids, is of an albuminous nature, slightly viscid to the touch, perfectly pellucid, but inclining to yellow in the larger ovules.

The ovaries are supplied with blood by branches from the spermatic arteries, and their nerves are offshoots from the renal plexus. Their absorbents, which are scanty and extremely delicate, empty into those of the kidney.

The ovaries are subject to inflammation, suppuration, softening, tubercles, melanosis, scirrhus, encephaloid, fibrous growths, and serous cysts. Almost all these affections occur after puberty, seldom before ; and they are much more common, as a general rule, in the married than in the single.

The anatomical characters of *acute ovaritis* are increased vascularity, softening, and sero-purulent effusion. In violent attacks, the organ is of a deep red color, much swelled and gorged with blood. On cutting into the parenchyma-

tous structure, it will be found succulent, and to contain small globules of pus, or to be converted into a pulpy, disorganized mass. When the disease affects the albugineous and serous coverings, lymph is very apt to be poured out, sometimes in great quantities, by which the ovary is embedded, and firmly attached to the adjoining viscera. In such cases, I have known the gland to be permanently fixed on the sigmoid flexure of the colon, the bladder, or body of the womb; and, in five or six instances, I have seen the fimbriated extremity of the Fallopian tubes firmly glued to the ovary, either on one or both sides. Under the latter circumstance, the individual must of course be sterile.

Ovaritis, especially the puerperal variety, sometimes passes into *suppuration*. The matter is commonly of a thick cream-like consistence, such as occurs in phlegmonous abscess, and it may be either infiltrated into the parenchymatous structure of the organ, or collected at one or more points. The quantity of fluid, though usually small, is sometimes almost incredible. In a woman, aged thirty-five, whose case is recorded by Dr. Taylor, of Philadelphia, it amounted to sixteen quarts. The right ovary occupied the whole of the abdominal cavity, and was converted into a large vascular sac, weighing seventeen pounds after the removal of its contents. The disease, which was of about four years' standing, was imagined to be an encysted dropsy, and its real nature was only discovered after death. During the latter part of her life, the woman suffered under dyspnoea, severe cough, difficulty of lying, and œdema of the lower extremities. The abdomen was unusually large, and fluctuated feebly on pressure. The uterus was sound.\* The matter thus formed may escape into the pelvic cavity, the rectum, vagina, or urinary bladder. In some cases it finds its way into the bowels; and occasionally it has been known to travel along the course of the round ligament of the uterus, and work its way out at the inguinal ring.

*Softening* of the ovary is a very uncommon affection. It generally results from active inflammation, and occasionally coexists with puerperal peritonitis. Under the influence of this disease, the organ becomes tumid, infiltrated with sero-purulent matter, extremely soft, and lacerable. In some instances, the entire structure of the ovary is reduced to a dark-colored vascular pulp, in which it is impossible to perceive the slightest trace of its natural organization. In other cases, again, the organ is of a dark complexion, hard and friable, like a half-rotten pear.

*Tubercles* of the ovary are rarely met with, being still more uncommon here than in the testicle. Thus far they have been observed chiefly in females of a scrofulous diathesis, after the decline of the menses. These bodies existed in one-twentieth of the persons who died of pulmonary phthisis under the care of Dr. Louis. They do not give rise to any particular symptoms; and, as they present the same characters as in the other organs, it is unnecessary to say any thing further concerning them in this place.

The ovaries are sometimes, although very rarely, affected with *melanosis*. A case reported by Professor Alison, of Edinburgh, admirably illustrates this disease. The ovaries, several times larger than their natural size, lay in front of the uterus, in the lateral iliac regions. Their outer surface had a dark, shining, lobulated appearance; and their substance was found to be uniformly black, as if they had been steeped in China ink.

*Scirrhus* of the ovary is often found in connection with serous cysts, ence-

\* North American Medical and Surgical Journal, vol. i., p. 443, 1836.



phaloid disease, and fibrous growths, but is rarely met with alone. The viscus is enlarged, often many times beyond the natural bulk, hardened in texture, and of a light yellowish color, with membranous filaments, of a dense, fibrous nature, intersecting it in different directions. This change of structure is similar to what takes place in the testicle; it seldom evinces any disposition to ulcerate, and frequently continues a long period without affecting the general health.\* The disease is most apt to come on some time after the cessation of the menses; and, in its progress, the enlarged and indurated viscus sometimes degenerates into a lardaceous, hydatid, cartilaginous, or bony state. Sharp, lancinating pains, referrible to the region of the ovary, with dysmenorrhœa, often attend this affection, and serve to distinguish it from other lesions.

More common perhaps than scirrhus is *encephaloid*, which usually runs its course with frightful rapidity. It may occur at any period of life, soon after the appearance of the menses, and it seems, in some instances, to be called into activity by the process of impregnation. Generally the brain-like matter, which distinguishes this disease, is found in small, irregular masses, enclosed in a distinct cyst, of a fibrous, cartilaginous, or bony texture. These masses sometimes attain a very great magnitude. In the case of a young woman, narrated by Dr. Carswell, the ovary was as large as the gravid uterus at the full term. They are usually of different shades of color, being of a pale olive, brownish, or mahogany, in some places, white, cream-like, or greyish in others. Branches of vessels may often be traced, in great numbers, into their structure; and not unfrequently they contain large cysts, filled with serum, pus, or sanious fluid. In some cases, though this is rare, the ovary is transformed into a large lumpy sac, the interior of which presents an areolar arrangement, and is occupied by a glistening, semi-concrete, jelly-like substance, constituting the *gelatiniform cancer* of Cruveilhier.

Dr. Seymour,† of London, has pointed out the connection which so often exists between this disease, scirrhus, and fungus hæmatodes in other parts of the body, especially the pylorus and the lymphatic glands. Its presence during life may be suspected by the deteriorated health of the patient; the wan and sallow countenance; the progressive emaciation and debility; by the unevenness and rapid growth of the tumor; and by the occasional occurrence of sharp, lancinating pains in the pelvic region.

*Fibrous tumors*, similar in their texture to those of the uterus, occasionally grow from the substance of the ovary. They are said to be of common occurrence in European women, but are seldom seen in the females of this country. Varying in size between a hazelnut and an orange, they are of a greyish color, firm consistence, and attached usually by a long, narrow foot-stalk. Occasionally these tumors coexist with scirrhus, encephaloid, or serous cysts; and it is not uncommon to find in them small, irregular cavities, filled with a thick, dirty-looking fluid. Sometimes they are interspersed with cartilaginous, osseous, or earthy concretions.

The ovary is liable to the *osseous transformation*. The lesion is most common in advanced age, and may affect the entire organ, or be limited to its investing membranes. The tumor thus developed sometimes attains an extraor-

\* In the case of a woman, forty-five years old, related by M. Vetter, a French writer, the right ovary was transformed into a tumor weighing fifty-six pounds. Its substance was homogeneous, greyish, and of a cartilaginous consistence, excepting at a few points, where it was softened, and of the character of the cerebral tissue. The disease was brought on by a blow, seventeen years before. (Bulletin des Sciences Médicales, Oct. 1825.)

† Diseases of the Ovaries, p. 61. See his work for plates.

dinary volume. In the case of a colored woman of sixty, mentioned by Professor Geddings,\* of Charleston, it weighed fifteen pounds, and was nine inches in length by seven and a half in breadth. The interior of the tumor was occupied by about eight ounces of curdy matter; but the remainder was so hard and resisting that it could only be divided with the saw. From three to four-fifths of its substance were composed of bony matter, partly in the form of homogeneous, solid nodules, partly in that of plates and spicules, cemented together by tough, fibrous tissue. The ossific transformation was not confined to the external envelope of the organ, but extended through its entire substance, and had supplanted every vestige of the natural structure. Similar examples are related by Henning,† Stork,‡ Schlenker,§ Walther,|| and other authors.

There are probably no organs in the human body in which *serous cysts* are more frequently developed than in the ovaries. Assuming every variety of shape, they are most generally globular, ovoidal, or pyriform, and vary in size from the smallest nut to the magnitude of a large melon. Sometimes the whole ovary is converted into one enormous sac; at other times the cysts seem to be gregarious, or united into clusters, having no communication with each other. Occasionally the sac is multilocular, or divided into small compartments. The contents of these cysts vary in color and consistence in different cases. In some, the fluid is thin, pale, and ropy; in others, thick, and dark-colored, like coffee-grounds; in others, purulent, sero-purulent, sanious, meliceric, saponaceous, tar-like, greasy, or suety.

The chemical constitution of the watery contents of these tumors varies in different cases, and even in different portions of the same sac, especially when it is of a multilocular nature. This subject has recently been investigated by Dr. G. O. Rees, of London, and the results of his labors are comprised in the able and elaborate paper of Dr. Bright on "Abdominal Tumors," in Guy's Hospital Reports.¶ In the following analysis, the fluid was obtained from a small cyst, about the size of a hen's egg, which was completely covered by the fibrous tunic of the ovary, and furnished with numerous little vessels.

Water	-	-	-	-	-	940.10
Albumen [with traces of fatty matter of the blood and phosphate of lime]	-	-	-	-	-	47.75
Albumen, existing in solution as albuminate of soda	-	-	-	-	-	6.69
Chloride of Sodium	-	-	-	-	-	3.76
Carbonate of Soda, with traces of sulphate	-	-	-	-	-	1.70
						<hr/> 1000.00

The fluid was clear, limpid, slightly mucilaginous, and alkaline, producing a permanent effect on reddened litmus. Its specific gravity was 1018.2.

The following is an analysis, by the same gentleman, of four other specimens, taken from the same patient.\*\*

\* Southern Med. and Surg. Jour., May, 1838.

† Medical Fragments, p. 345.

‡ Am. Med. ii. p. 245.

§ De Singulari ovarii Sinistri Morbo, § 8.

|| Observ. Anat., p. 44.

¶ No. vi., April, 1838, p. 193.

\*\* Op., cit. p. 209.

	No. 1. Clear, light straw-colored, alkaline, sp. gr. 1017.	No. 2 Dark-colored, muddy, neutral, sp. gr. 1017.	No. 3. Alkaline, and approaching in character to white of egg.	No. 4. Clear, straw-colored, containing a pearly, scaly-looking substance.
Water - - - - -	190.9	190.70	195.2	187.7
Albumen, with traces of fatty matter -	4.1	4.25	1.8	7.6
Albumen, existing in solution as albuminate of soda - - - - -	3.7	3.62	1.1	. . .
Alkaline chloride in small quantity, and sulphate, with carbonate of soda, from decomposed albuminate - - - - -	0.8	0.78	1.2	4.0
Extractive, soluble in water and alcohol -	0.4	0.45	0.5	0.5
Chloride of sodium with carbonate, from decomposed lactate of alcoholic extract }	0.1	0.20	0.2	0.2
	200	200	200	200

The tumor from which the above specimens were procured, consisted of one large cyst, which contained a bucketful of a straw-colored and tenacious fluid, which towards the bottom was opaque and puriform. The pearly, scaly-looking flakes in No. 4, were particles of cholesterine. The patient was in her thirty-eighth year, had borne several children, and had labored under ovarian disease for a long time.

In the multilocular form of ovarian dropsy it often happens that each cyst is filled with a peculiar product, aqueous, or gelatinous, sanguineous, fatty, or even chalky, as in the example recorded by Cruveilhier. These substances are liable to become decomposed, when they exhale a putrid odor, and give rise to different kinds of gases.\*

The brownish, turbid, or coffee-grounds-looking fluid, contained in certain ovarian cysts, probably derives its color from the admixture of blood, poured out by the vessels which are distributed through the parietes of the main sac, or the internal septiform processes, and probably undergoing a species of decomposition by long sojourn in the tumor. Julia Fontenelle ascertained, by analysis, that this fluid is composed of 6 parts of fibrin, 97 of albumen, and 34 of concrete jelly, with a little phosphate and hydro-chlorate of soda. In the case which he examined the matter was contained in a cyst two lines in thickness, and imperfectly divided.† In a woman, thirty-five years of age, whom I tapped along with Professor Cobb, two years ago, the fluid, amounting to between four and five gallons, was of the color and consistence of thin molasses.

Ovarian cysts, especially the simple variety, are sometimes nearly entirely occupied by a yellow, granular substance, not unlike butter. The quantity varies from a few ounces to several pounds. In a case recorded in a German periodical it amounted to fourteen pounds. This matter has been analyzed by Dr. Bird,‡ of London, who finds 100 parts to contain the following ingredients:

\* Practical Treatise on the Diseases of the Uterus, by Boivin & Dugès, translated by Dr. Heming, p. 460.

† Boivin & Dugès, op. cit., p. 459. Archives de Méd., t. iv., p. 257.

‡ London Lancet, for 1842-3, p. 30, N. York edition.



Butyrine, with butyric acid	-	-	-	27.
Elaine, with traces of margarine	-	-	-	38.
Margarine	-	-	-	24.
Fibrous mass	-	-	-	2.5
Water	-	-	-	8.5

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 100

The *quantity of fluid* varies from a few ounces to many quarts. Imhoff\* relates a case of forty-two pounds; Camper,† one of eighty, and Mohrenheim,‡ one of eighty-five. The walls of the cyst, in this case, were two lines thick, white, and remarkably tough. Stork§ describes an ovary which contained thirty quarts of fluid; Heister,|| one of forty-five; Nuck,¶ one of fifty. Schorkopf,\*\* mentions an instance in which the quantity of water amounted to one hundred and twenty pounds; and Targioni,†† one of one hundred and fifty. In the case of a colored woman of forty, recently reported by Dr. Hintze, of Baltimore, the cyst contained upwards of twenty-three gallons. It was nearly spherical in its shape, communicated with the urinary bladder and inferior portion of the colon, and was of a thick, compact, fibrous structure. But all these cases sink into insignificance when compared with those recorded by Mead and Martineau. In the first, the patient was tapped sixty-seven times in five years and a half, and lost two hundred and forty gallons of fluid.‡‡ In the second case, paracentesis was performed eighty times in twenty-five years, and the entire quantity of water removed was eight hundred and twenty-eight gallons, three quarts, and one pint. The largest amount of fluid lost at one operation was fifty-four quarts. Thirty-nine quarts were evacuated after death, which occurred three weeks after the last tapping. The whole of this enormous quantity of water was secreted by the left ovary, which was expanded into one vast sac, extensively ossified, and not very thick. §§

Thus an ovary which, in the normal state, scarcely weighs two drachms, will expand, under disease, to a magnitude capable of holding an immense amount of fluid. Externally, the sac is commonly smooth and polished; internally, it is rough and irregular, sending off frequently little septiform processes. In some instances it has a dense, cartilaginous feel; and occasionally it has been found partially ossified. These sacs, it may now be observed, constitute what is termed *encysted dropsy* of the ovary, and there is reason to believe that they often arise from a diseased state of the Graafian vesicles.

The causes of ovarian disease are not well understood. The disease is most common in married females, but is occasionally observed in old maids, and even in young girls soon after the age of puberty. Its progress is usually very tardy, and the principal suffering which it induces is from the pressure exerted by the tumor upon the surrounding parts. The general health often remains good for many years. How life is supported and the system nourished, when the accumulation is so enormous as in some of the examples above cited, it is not easy to conceive, much less to explain.

*Hydatids* are occasionally found in the secysts. My friend, Dr. McDonald,

\* Act. Helvetic., vol. i., app., p. 1.

† Mém. de la Soc. Méd., 1788, p. 46.

‡ Wiener. Beiträge, B. 1, S. 326.

§ Archiv. für Geburtsh.

|| Medic. Chir., Wahrnehmungen, B. 1, S. 601.

\*\* Diss. de Hydropse Ovarii, § xvi.

¶ Adenographia Curios., cap. iv., p. 84.

†† Raccolta prima de Osserv. Mediche. Fior, 1752.

‡‡ Seymour on Diseases of the Ovaria, p. 47.

§§ Philos. Trans. of London for 1784. vol. lxxiv., p. 472.

of Alabama, described to me, not long ago, a case in which there were upwards of two hundred of these parasitic growths, of all sizes, between a small pea and a large fist. Some of them adhered to the inner surface of the sac, by narrow, slender necks; others were loose, and floated about in the effused fluid, the quantity of which was very great. The hydatids, which are generally, if not invariably, of the acephalocystic kind, sometimes amount to several thousands.

*Teeth, bones* (Fig. 240), cartilages, and hairs (Fig. 241), are sometimes discovered in ovarian cysts, wrapped up in a peculiar saponaceous, fatty, or suety matter.

Fig. 240.



Fig. 241.



One of the most extraordinary examples of this kind perhaps on record is to be found in the "Breslau Collections" for 1722. The woman had been afflicted from her earliest youth, and died when she was thirty-eight years old: on inspection, the right ovary was found converted into a large sac, weighing fifty-four pounds. The tumor was of a soft, meliceric consistence, and scattered through its substance were several fragments of bone, together with a considerable quantity of hair, some of which was rolled up in tufts two feet long. Of the osseous pieces, which were eight in number, the largest was eight inches in length by two inches in thickness; and several of them evidently appertained to the jaws, as they were surrounded by incisor, canine, and molar teeth. Cleghorn discovered in an ovarian tumor irregular pieces of bone, hairs, and twenty-seven teeth; and similar cases are described by Bicker, Murray, Sœmmering, Baillie, Cruveilhier, and other writers. The hairs are said by Meckel to be furnished with distinct bulbs; and, in their color, they present every variety, like those of the head, to which they bear a great resemblance. These singular productions are not confined to any particular period of life; they are observed with almost equal frequency in the married and in the virgin female, and, what is remarkable, instances are

not wanting in which they have been found in different parts of the male, especially in the stomach and intestines.

Ruysch discovered teeth and hair in the stomach of a man; Mr. Brodie, a jaw, with full-grown teeth, in the urinary bladder; Gordon, hair, with a piece of bone, in the thorax. In a case, the particulars of which are detailed in the third volume of the "Berlin Collections," the tumor, which was of an adipous nature, adhered to the diaphragm, and contained twenty-one fragments of bone, four teeth, and a tuft of hair; and in another, recently reported to the Royal Academy of Medicine at Paris, by Dr. André, of Peronne, teeth and hair were found in the testicles of a boy, aged seven years.\*

\* Mémoires de l'Académie Royale de Médecine, t. iii., p. 480.

A case in which a cyst containing fatty matter, hair, and several teeth, was found a little below the right kidney, in a dead gelding, has been recorded by Mr. Coleman, an eminent veterinary surgeon of London. The animal was seven years old, and had died of glanders. The tumor was about the size of a horse's testicle, oblong in its form, of a hard, osseous consistence, and loosely attached, by a long slender neck, to the peritonæum. One part of the morbid mass was made up of a cyst which contained one incisor and two molar teeth, with a piece of jaw-bone; the remainder was composed of about two-thirds of fat and one-third of hair, of a black color, and surrounded by a separate bag. As the early history of the animal could not be procured, it was impossible to ascertain whether both testicles had previously been removed; but the probability is, as Mr. Coleman conjectures, that one of these organs remained in the abdomen; an opinion which is favored by the form, size, and situation of the tumor.\*

Concerning the mode of origin of these singular products, various opinions have been expressed by writers. In the majority of cases, it is highly probable that they are the result of conception, the embryo being developed in the ovary instead of the uterus; but this explanation cannot apply, certainly, to those instances in which these substances are found in the male sex, and in the young, immature female. Their presence here can only be accounted for, on the theory of *monstrosity by inclusion*, so well described by Dr. Olivier, of France.

Tumors of the ovary, from whatever cause arising, are liable to be confounded with ascites, from which, however, they are easily distinguished by the following signs: 1, they are generally more tense, circumscribed, and protuberant; 2, they are situated more to one side of the abdomen, especially in the early stage of their existence; 3, they always lie in front of the intestines, never posterior to them; 4, they are less influenced by change of posture, and they do not fluctuate so distinctly under the finger. In ascites the fluid gravitates to the lowest part of the abdomen in the erect and to the posterior part in the recumbent position; 5, ovarian tumors always grow slowly, and are seldom attended with much constitutional derangement; ascites, on the contrary, often comes on rapidly, and the general health is invariably impaired. Additional evidence is to be obtained from instituting a vaginal examination. In peritonæal effusions, the neck of the uterus always occupies its accustomed place, whereas in ovarian enlargements it is usually drawn up, so as to be beyond the reach, in great measure, of the finger. The organ is also, in some instances, dragged to one side. It may be further stated, that, when the cyst is multilocular, the surface of the tumor is commonly irregular, and yields a sensation, on being percussed, as if it contained liquids of different degrees of consistence.

One of the ovaries is sometimes wanting, in which case it almost always happens that the other is considerably enlarged, full twice the natural size. I have met with several instances of this kind, and others are referred to by Dugès, Meckel, and Hooper. Occasionally both organs remain in a sort of rudimentary state, being scarcely as large as a bean, and of a dense fibro-cartilaginous consistence. In such cases, of which a number of examples have fallen under my observation, there is frequently an entire absence of the vesicles of De Graaf.

*Atrophy* of the ovary is frequently observed in old females, after the cessation of the menses. The period for the exercise of the reproductive function



being passed, the organ is no longer needed, and it accordingly, in many cases, greatly decreases in volume, the interior structure is dry, dense, and almost crisp, and the serous and fibrous envelopes are remarkably rough and puckered. Similar phenomena are sometimes witnessed in women who are habitually barren.

The ovary is sometimes, though rarely, the seat of *hemorrhage*. This may occur in three distinct situations: 1, in the parenchymatous structure; 2, in the ovules of De Graaf; 3, immediately beneath the fibrous envelope. The blood is generally collected into irregularly rounded masses, varying from the size of a currant to that of a garden pea. It is either of a dark red color or almost black; coagulated, or partly fluid and partly solid. Ovarian hemorrhage is most common in young plethoric females, and usually occurs in combination with a highly congested state of the uterus, the Fallopian tubes, and broad ligaments.

The Graafian vesicles are liable to morbid alterations. The fluid which they contain is often red, brownish, or even black, from the admixture probably of blood.\* Occasionally they are filled with purulent matter; they have been found perfectly dry and empty; they are sometimes absent as a congenital defect; and Morgagni† has mentioned instances in which they were converted into cartilage and even bone.

As a very curious and interesting question connected with the morbid anatomy of the ovaries, it will be proper here to allude briefly to what is called the *luteal body*, more especially as the subject is one of considerable interest in a medico-legal point of view. In the ovaries of a woman who has recently been pregnant, we may observe, in addition to the ovules of De Graaf, a tender, friable, vascular structure, generally of a circular or oval shape, the dimensions of which vary according to the period which has elapsed between the conception and the examination. The first account of this body was given by Fallopius towards the latter part of the seventeenth century: it was afterwards more particularly described by Haller and his disciples; and, in our own times, it has been particularly investigated by J. F. Meckel, Blundell, and Sir Everard Home. For the latest and most accurate additions, however, to our stock of knowledge relative to this topic, we are indebted to Professor Montgomery, of Dublin, the results of whose observations are comprised in a short article, replete with valuable information, in the London Cyclopædia of Practical Medicine.‡

In reading the various accounts which have been published on this subject, one cannot help being forcibly struck with the contradictory statements presented by different authors. This confusion has been produced, in great measure, if I mistake not, by applying the term "*luteal body*" at one time to a separate structure, and at another to the cicatrice caused by the rupture of the ovarian membranes. The truth is, these are not, as many have supposed, identical parts, but parts that are perfectly distinct from each other, — a circumstance which must be constantly borne in mind if we wish to avoid error. With this remark, intended to obviate future perplexity, we may proceed one step further, and inquire into the nature of the luteal body, and into the character of the resulting cicatrice.

The color of the luteal body varies according to the period at which it is examined. In the early stage of its existence, it is always more or less red;

\* Morgagni De Causis Morborum, Epist. xxiii.—xxxvi. Seymour's Illustrations of the Diseases of the Ovaria, p. 43, London, 1830.

† Op. cit.—Epist. lii. § 2—xlvi., § 28; xlviii., § 44.

‡ See article *Signs of Pregnancy*, vol. iii., p. 496.

by degrees, however, it assumes, as its name indicates, a dull yellow complexion, not unlike that of the buffy coat of the blood ; after parturition, again, and generally several months even before that event, it becomes gradually more and more pale, and at length loses its characteristic tinge altogether. In some instances, indeed, the yellow color, from which this body derives its name, is entirely absent.

The structure of this body is strikingly glandular, resembling a section of the human kidney.\* In the early stage of its development, it is quite vascular, being surrounded by a large plexus of arteries and veins, branches of which penetrate it in every direction, and can be easily filled with injecting matter. Its surfaces are somewhat convex, like those of the crystalline lens, and the superficial one not unfrequently projects beyond the natural level of the ovary, resting upon it like the segment of a smaller globe. As it grows older its vascularity decreases, but its density sensibly augments.

In its form, the luteal body is almost always oval, in nine cases probably out of ten ; but, in some instances, I have found it circular, or rather presenting the appearance of a disk, slightly convex at the sides. Its size, like its color, is liable to considerable variety, according to the period at which it is inspected. In the early months of utero-gestation, the longer axis is stated by Professor Montgomery to be from four to five-eighths of an inch, and the shorter from three to four-eighths. Its thickness, according to the same authority, is generally less than its breadth. These measurements nearly coincide with those of the celebrated Rœderer, who says the luteal body is four lines long, three lines broad, and two lines thick. Surprised at the statements of these distinguished writers, and confidently believing that they were greatly exaggerated, Professor Parker and myself determined to put this matter to the test of observation. Unfortunately, however, the specimens which we could command were all taken from females who died either during labor or immediately after delivery, and offered us no opportunity for examining these bodies in the earlier stages of their formation. Yet, notwithstanding this, our investigations have fully convinced us that the assertions of Montgomery and Rœderer, as to the dimensions of the corpora lutea, are perfectly correct, and therefore in every respect entitled to confidence. That this conclusion is well grounded, the following facts will, I conceive, fully warrant.

The first examination was made upon a female who died within a few hours after the delivery of her third child, at the full term of utero-gestation. On the anterior surface of the right ovary was a distinct luteal body, of an oblong shape, opaque, two lines in length, one line and three-quarters in breadth, and scarcely half a line in thickness. It was of a pale yellowish color, opaque, homogeneous in its appearance, and of a fibro-cartilaginous consistence. Another luteal body was observed on the opposite organ, apparently more recent than the first, of a spherical form, two lines and a half in diameter, and encircled by a depressed, puckered cicatrice, four lines in length by three lines in breadth.

In the second case, that of a female who died soon after parturition, the luteal body, situated in the right ovary, was of a circular shape, two lines and a half in diameter, about the twelfth of an inch in thickness, and of a pale, yellowish color, similar to the buffy coat of the blood. It was surrounded by a cicatrice nearly five lines across, which was evidently formed at the expense of the serous and fibrous envelopes, and the margins of which had a rough,

\* Montgomery, *op. cit.*, p. 497.

tattered appearance. In other respects the surface both of this and of the left ovary was perfectly natural.

In the third examination, the luteal body was found to occupy the posterior surface of the left ovary. It was likewise of a circular shape, two lines in diameter, and of a pale greyish color, surrounded by a yellow areola about the fortieth part of an inch in width. To the knife it offered a good deal of resistance, and it was evidently of a fibro-cartilaginous nature. The right ovary exhibited nothing unusual, excepting that both surfaces were rough and puckered, from the presence, apparently, of several ancient cicatrices, the largest of which was nearly half an inch in diameter. In this case, also, death took place within the first twenty-four hours after delivery, at the full term of utero-gestation.

In the fourth case, the woman, who was about thirty-five years of age, and the mother of two children, died from an attack of cholera, at the end of the seventh month of her pregnancy. The left ovary was of the usual size, and perfectly natural in regard to its exterior. On cutting into it, a soft, spongy structure was discovered, of an irregularly oval shape, five lines and a half in length by four in breadth, and of a reddish color. No cicatrice could be detected over or around this substance, of the precise nature of which it was impossible to form any accurate idea. The right ovary contained what were thought to be three distinct luteal bodies. They were of a pale yellowish color, slightly mammillated on the surface, or studded with numerous little prominences, resembling the eggs of certain insects, and of a dense fibro-cartilaginous consistence. The largest was three lines and a half in length, one line and a fourth in thickness, and two lines and three-quarters in breadth. The other two were somewhat smaller, but had the same color and consistence; one of them, the most superficial of all, was surrounded by a distinct cicatrice, and projected some distance beyond the natural level of the organ. On looking at these bodies with a magnifying-glass they exhibited a singularly convoluted appearance, like that of the human brain, so well described by Sir Everard Home, in a paper in the London Philosophical Transactions.

If we couple the results of the preceding examinations with the fact that the luteal body gradually diminishes in size as utero-gestation advances towards completion, and at length partially or wholly disappears, it will be perceived, as was before intimated, that they strikingly corroborate the measurements of Montgomery and Røederer; in other words, they clearly show that the structure in question is much larger than is generally imagined, and very different also from the cicatrice which accompanies and surrounds it.

The manner in which this body is formed admits of easy explanation. The larger Graafian vesicles, it will be recollected, are always seated superficially, and are frequently from two to four lines in diameter. Now let us suppose that under the influence of its appropriate stimulus one of these little sacs bursts, and we can readily imagine what will be the result. In the first place, there will undoubtedly be an escape of its contents, whereby a cavity will be formed for the reception of the yellow body. Not only, it will be perceived, are the coats of the vesicle itself ruptured, but there is also a laceration, or, perhaps, more properly speaking, an absorption of the corresponding portion of the serous and fibrous envelopes of the ovary, caused by the pressure of the subjacent ovule, distended as it must be to the very utmost under the grasp of the fimbriated extremity of the Fallopian tube. The ovule having passed from its original bed, the cavity which is thus left is gradually if not immediately closed up with plastic lymph, poured out by the irritated and inflamed membranes of the ruptured vesicle, the inner of which, as was shown in a previous



section, is of a serous nature, and therefore well qualified to yield the substance alluded to. Generally the lymph is not perfectly pure, but blended with it there is more or less blood; and hence the reason why a recent luteal body is always of a redder color than one that is older. In a short time this new matter acquires solidity, its opacity diminishes, vessels shoot into it from the surrounding parts, and in this manner it becomes an organized structure, capable of withstanding, for a limited period, the action of the absorbent vessels of the ovary, but finally yielding to their influence. Such, in a few words, I conceive, is the mode of formation of the luteal body.

In regard to the accompanying cicatrice, which, as I have already endeavored to show, differs essentially from the yellow body itself, it is altogether dependent for its formation upon the general envelopes of the ovary. The serous and fibrous tunics of this organ being ruptured, the ulcerative absorption induced by the subjacent vesicle, a sort of ring is left, of an oval or circular shape, with ragged tattered edges of a greyish or whitish appearance, which surround the luteal body, and frequently project considerably beyond the level of its surface. By and by the ring contracts adhesions with the newly-deposited substance, the intervening opening diminishes in size, and the tattered edges finally approximate, leaving merely a radiated, linear, or stellated cicatrice, or rebuilding, if I may use the expression, the part so effectually as to render it impossible to determine where the rupture occurred.

Having thus pointed out, with as much fidelity as my reading and observation enable me, the difference between the luteal body and its accompanying cicatrice, let us proceed, finally to inquire at what period, if at all, these structures disappear, and how far they may be regarded as affording evidence of previous conception. It has been thought by many that the luteal body is a permanent ineffaceable texture, and therefore always indicative of the number of pregnancies; but this is unquestionably a mistake, both as respects the premises and the conclusion thence deduced. At what period after delivery its disparition is effected, is a circumstance which is not satisfactorily settled. Professor Montgomery, in the able paper already adverted to, distinctly states that he has never been able to detect the existence of the luteal body beyond the fifth month. In the case of a young woman who died at this period after giving birth to her first child, the structure in question was scarcely any larger than a mustard-seed, but the external cicatrice was still perfectly obvious, and served to point out the escape of the ovule. Judging from my own observations, I should be inclined to look upon the final disparition of this body as liable to much diversity, depending upon the state of the ovary, the age of the female, and a variety of other circumstances which must readily suggest themselves to the mind of the reader. In a case already referred to, the fourth that was examined by Professor Parker and myself, three distinct corpora lutea were observed, corresponding exactly with the number of offspring. Only one of these had a characteristic cicatrice; it was of a yellow buff color, remarkably prominent, several lines in diameter, and comparatively soft and friable. The most ancient was quite small, and would, no doubt, have shortly disappeared had the woman lived. This examination cannot be regarded, it is true, as conclusive; but, as far as it goes, it certainly corroborates the view we have taken, that the luteal body occasionally continues much longer than is imagined by Dr. Montgomery, the cicatrice in the mean time becoming entirely effaced.

The next topic to which I proposed to advert is, how far the luteal body can be regarded as proof of previous impregnation? Concerning this question different opinions have been expressed by different writers; some contending that this substance is always a certain indication of this condition;

others, that it affords, at best, very equivocal evidence. Those who espouse the latter side of the question allege that it can be of no value in this respect, inasmuch as it is frequently produced, both in the human subject and in animals, in consequence merely of strong sexual excitement, without any intercourse whatsoever. Upon this subject, the researches of Montgomery are, I conceive, perfectly conclusive. "In addition to the authorities here cited, we may be allowed," says this distinguished writer, "to add the result of our own observations, which have been now continued through a period of more than six years, during which time we never omitted a single opportunity within our reach, for examining the bodies of women of all ages, and under all the varying circumstances of virginity, after intercourse, during gestation, and subsequent delivery, at different periods from conception, — these opportunities having been afforded by more than one large hospital, as well as in private practice. We have also dissected hundreds of the inferior animals with reference to this point, and have in our museum preparations of ovaries exhibiting the corpus luteum in different conditions in the human female, and also in cows, mares, sheep, sows, goats, bitches, cats, hares, and rabbits; and our firm conviction is of the truth of both of Haller's propositions, namely, that conception never happens without the production of a corpus luteum," and "that the corpus luteum is never found in virgin animals, but is the effect of impregnation." In regard to the virgin corpus luteum, or that which results simply from lascivious excitement, it can be readily distinguished, according to Montgomery\* from the genuine luteal body, by the following particulars: 1. There is no prominence of the ovary over it. 2. The external cicatrice is wanting. 3. There are often several of them in both organs, especially in females who die of tubercular phthisis. 4. It is not vascular, and cannot be injected. 5. Its texture, instead of being tender, friable, and regularly glandular, is inferior, consists merely of the remains of a coagulum, or of a fibro-cellular substance. 6. It has neither the central cavity, nor the radiated cicatrice which results from its closure.

Finally, it should be observed that the accompanying cicatrice, like the yellow body itself, is gradually effaced generally within the first year after delivery, sometimes, indeed, several months sooner, but at other times, not until considerably later. Taken by itself, it affords no evidence of previous conception, inasmuch as it is impossible to distinguish it from a cicatrice produced by the discharge of an abscess, a tubercular excavation, or a sanguineous effusion. The opinion, therefore, that the scars remain for life, and exactly indicate the number of births, is absurd and erroneous.

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### SECTION III.

#### OF THE FALLOPIAN TUBES.

The Fallopian tubes are two slender tortuous canals, about four inches and a half in length, which extend between the ovaries and the superior angles of the uterus, with both of which they are connected. Their caliber is extremely narrow in the inner half of their extent, being scarcely large enough

\*London Cyclopædia of Practical Medicine, vol. iii., p. 502.

to admit a common-sized bristle ; but, as they proceed to their destination, they gradually augment in diameter, and finally terminate in a wide, trumpet-shaped mouth. They serve as excretory ducts to the ovaries, and consist each of three tunics, — an external one, which is serous, an internal, which is mucous, and an intermediate, which seems to be similar in its structure to the spongy body of the urethra, and, like it, capable of temporary erection. The vessels of the Fallopian tubes are branches of the spermatic arteries, — the nerves of the hypogastric plexus.

Thus organized, the Fallopian tubes are liable to attacks of acute and chronic *inflammation*, both in the virgin and in the gravid state. These diseases may be propagated to them from the uterus, or they may have an independent origin : they may be limited to one tube, or even to a part of that tube, or they may involve both ducts simultaneously. Inflammation is most apt to be present in dysmenorrhœa and puerperal peritonitis, when the tubes are extremely vascular, and of a deep red color ; and, in severe cases, they are closed up either partially or entirely with coagulating lymph, or distended with purulent matter. In a case mentioned by Professor Harrison, of Cincinnati, the left tube contained at least an ounce of thick, laudable pus, the right about three drachms : the mouth of the uterus was red and tumid, and the whole of its inner surface bathed with purulent matter. Occasionally, when the accumulation is very great, the tube bursts, and the matter escapes into the pelvic cavity ; at other times, it discharges its contents through the rectum, the small intestines, the urinary bladder, or the uterus.

In some instances, these tubes terminate in a cul-de-sac ; and cases are occasionally witnessed in which their fringes are destroyed by ulceration, or by adhesion to the ovaries or adjacent organs. Their canals are also sometimes obstructed by inspissated mucus, lymph, and scrofulous matter. In a young girl of ill fame, examined by Professor Harrison, the Fallopian tubes, very greatly dilated, contained a thick, cheese-like deposit ; and to the outer surface of each were appended two small tumors, filled with a similar substance. All these lesions are so many causes of sterility.

Fibrous tumors sometimes grow from the Fallopian tubes ; sometimes in their interior. They are usually of a rounded shape, very hard, and exhibit the same appearances, when cut into, as fibrous tumors of the womb. Malignant disease occasionally invades these passages, commencing in them either as an original affection, or extending to them from the uterus or the ovaries. The true hydatid, I believe, has never been found here ; but very often small cysts, filled with a thin, limpid fluid, are seen hanging from the fimbriated extremities of these tubes, and this sometimes in women who have never borne children. Their size varies from that of a currant to that of a walnut, an orange, or even a small gourd.

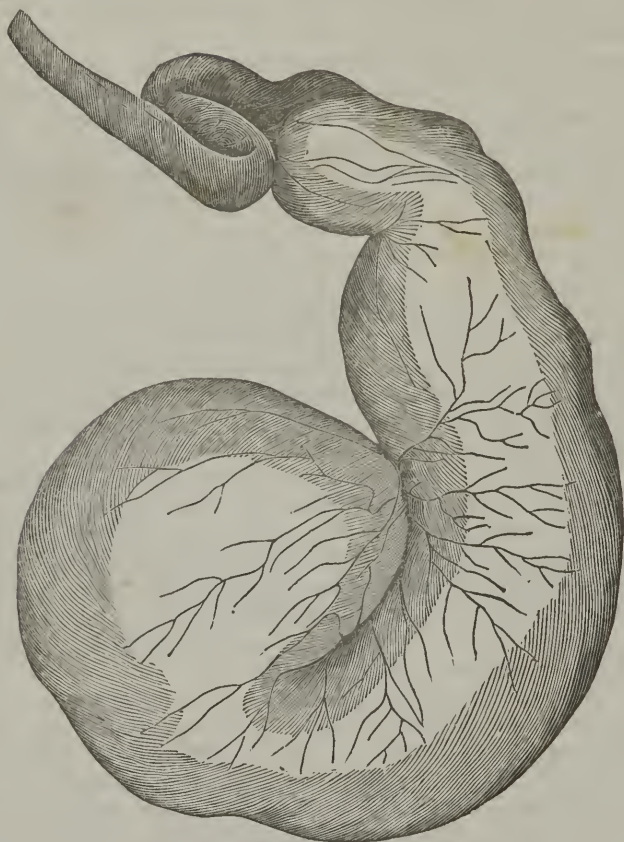
Accumulations of *watery fluids* are sometimes seen in the Fallopian tubes. (Fig. 242.) The most usual quantity is from one to two ounces ; but occasionally it amounts to many pints. In such cases, the duct commonly assumes a pyriform shape, and greatly augments in thickness,—a condition which is absolutely necessary to prevent its rupture. De Haen relates an instance in which the tube weighed seven pounds, and the cavity contained nearly four gallons of fluid ; and a still more extraordinary one has been detailed by Madame Boivin.

When the ovum is retained in the Fallopian tube, as has been known to happen in some rare cases, it generally grows until the third, fourth, or fifth month of gestation, and then makes its escape. In some instances, the escape



is preceded by ulceration ; but more commonly there is a rupture of the tube, its attenuated walls being incapable of further distention. Fatal hemorrhage almost always follows this accident. A very instructive case of this species of pregnancy is mentioned by the late Dr. Clarke, in the second volume of

Fig. 242.



the London Medical and Chirurgical Transactions ; a second is detailed in a late number of the American Journal of the Medical Sciences ; and a third was recently communicated to me by my friend, Dr. Kennedy, of Easton, Pennsylvania. In this case, the tube was ruptured in consequence of a blow on the abdomen, and the woman gradually sunk under the hemorrhage, having been pregnant about seven months.

Of the symptoms of these various affections, it will not be necessary to speak ; I need only remark, concerning them, that they are generally very obscure, and that they do not afford any indications by which the lesions of the Fallopian tubes can be distinguished from those of the rest of the uterine system.

## SECTION IV.

## OF THE VAGINA AND VULVA.

The vagina is liable to ordinary and specific *inflammation*. The disease is marked by the usual anatomical characters, and is often attended with profuse discharges of purulent matter, of a very acrid nature, and mixed at times with blood. In bad cases, abscesses are formed in the submucous cellular texture; and instances have been witnessed where the parts were rapidly destroyed by gangrene. A coating of adventitious membrane is sometimes observed, especially when the inflammation is connected with disease of the mouth and neck of the uterus. Ulcers of the vagina are generally referable to the syphilitic, cancerous, or scrofulous poison, and do not differ from the same class of sores in other regions of the body.

*Polypes* are occasionally developed in the walls of the vagina; but this is very rare, and I have not seen an instance. Tumors of this description may attain a very considerable magnitude, so as not only to distend the whole tube, but project eight or ten inches down the thighs. Baudier has published an account of a polypous growth of the vagina, the weight of which was ten pounds and a half; and similar cases are narrated by Dupuytren and other authors.

A singular tumor is sometimes observed in this tube, which seems to consist in a morbid enlargement of the mucous follicles so abundantly found in this division of the mucous system. I once saw a swelling of this kind immediately beneath the orifice of the urethra of a young lady, the mother of four children. It was of a spherical shape, about the size of a walnut, and of a white, glossy appearance, with a rough, corrugated surface. She told me that it was at times painful, and that she had first perceived it eight years ago, soon after her marriage. I opened the tumor with a lancet, and let out a considerable quantity of a viscid, glairy fluid, like the white of eggs. The fluid never reaccumulated.

The vagina is sometimes covered with varicose veins, chiefly in the submucous cellular substance. They are spread out in an irregularly arborescent manner, and are occasionally four or five times as large as in the natural state. The coats of the vessels may be entirely healthy, but more frequently they are diseased, being attenuated at one point, and thickened at another; in bad cases the stagnant blood sometimes coagulates, followed by inflammation and abscess. During parturition one or more of the enlarged veins have been ruptured by the pressure of the child's head, and copious hemorrhage has been the result.

*Obstruction* of the vagina is liable to occur from inflammation, and the consequent effusion of fibrin into the submucous cellular tissue. In this way, not only the orifice, but the greater part of the tube, may be much diminished in size, either uniformly, or, as more frequently happens, at particular points. The stricture, though generally partial, occasionally completely encircles the vagina, presenting the appearance as if it had been bound by a ligature. The affected part feels firm, thick, and rigid, not unlike the mouth of the uterus, for which it has sometimes been mistaken during labor. The obstruction may be seated at any part of the length of the tube, but in most cases it is found within the first two inches of the lower outlet. The outlet of the vagina, again, may be closed up by an imperforate hymen, or by a dense, pale, gristly substance.

The vagina is sometimes very *short*. Baillie states that he has seen it not more than half its natural length; and still more remarkable examples are mentioned by Dr. Dewees. In one of these the whole distance to which the finger could be passed did not exceed an inch and a half; and in the other, which seemed to be connected with an absence of the uterus, the tube terminated in a cul-de-sac. At other times the vagina is entirely wanting, greatly contracted, or converted into a solid, gristly mass; and cases have occasionally been noticed where, through accident or congenital deficiency, it communicated with the bladder and the rectum, at various distances from the anus. In a female mentioned by Sue, the rectum opened into the vagina, and the vagina into the bladder.

The vagina may be *double*. Of this I have never seen an instance, but cases of it are recorded by Haller, Eisenmann, Bartholin, Callisen, Meckel, and other writers. The septum sometimes extends the whole length of the tube, dividing it into two cylindrical canals, each of which may terminate inferiorly by a separate aperture. Callisen refers to two cases where the canals thus formed were closed each by a perfect hymen. In some instances, which, however, must be extremely rare, the frænum is situated transversely, constituting a sort of diaphragm, which prevents the flow of the menstrual fluid.

We have already intimated that the great lips are subject to *bloody infiltration*. This lesion, which results from a rupture of some of the neighboring vessels, during or immediately after delivery, usually involves only one of these organs, seldom both at the same time. The tumor which is thus formed is generally of an irregularly oblong shape, with a dark livid surface, more or less compressible, and about the size of a hen's egg. Occasionally, however, it is much larger, equalling or surpassing the volume of a fœtal head, and containing from ten to twenty ounces of blood. The effusion commonly takes place suddenly, or in a very short time, and, when copious, it almost always makes its escape spontaneously, by lacerating the superincumbent textures, or it remains, and speedily induces gangrene in them. In the latter case, the blood is generally of a very black color, partly fluid and partly coagulated, and emits a highly offensive odor. The infiltrated tissues are sometimes frightfully lacerated, and converted into a dark, shreddy substance, without any trace whatever of their original characters.

The external lip may be the seat of different kinds of *ulcers*; and they are likewise liable to gangrene, malignant disease and bloody infiltration. An eminent English physician, Mr. Kinderwood, many years ago described a fatal disease of the vulva of young children, which, commencing at one or more points of the mucous surface, rapidly spreads over the nymphæ, clitoris, and hymen. Gangrenous spots appear in a very short time, and continue to enlarge until the parts are converted into dark-colored, fetid sloughs. Great prostration of strength, accompanied by fever and severe pain, is the most prominent symptom of the complaint.

Dr. Parker and I recently removed a tumor of this sort from the entrance of the urethra of a young lady of eighteen. It was of a conical shape, nearly an inch and a half in length by three-quarters of an inch in diameter, very sensitive, of a bright florid color, elastic, and compressible. On maceration for a few days in water it became perfectly white, and seemed to be composed essentially of bloodvessels, supported by soft cellulo-fibrous substance.

*Warty excrescences* are often seen within the vulva. In some instances they extend into the vagina, and down the perinæum as far as the margin of the anus. Their number may be very great. In one case, that of a young girl of eighteen, I counted as many as sixty-five, of all sizes, from that of a mustard-



seed to that of a raspberry. Usually they are of a pale florid color, of a fibro-cartilaginous consistence, rough on the surface, pediculated, and somewhat painful on pressure. Their origin in most cases is referable to gonorrhœa and syphilis.

*Polypes* of the vulva are of very infrequent occurrence. They are generally of a pyriform figure, conical, or globular, and attached by a narrow and tolerably long pedicle. In their volume they vary between an almond and a child's head, though they rarely exceed that of the fist. Occasionally they are so large as to hang down between the knees. At an early period they are of a spongy consistence and of a bright florid color; but they are liable to become hard, and to assume a pale, mottled appearance, especially when they project beyond the vulva. Ulceration occasionally occurs, and when this happens there is often a copious discharge of bloody, fetid matter. Their structure is usually of a soft, fleshy nature, either uniformly, or interspersed with serous cysts, or masses of fibro-cartilage. In a few instances they have been partially composed of medullary matter. Gerdy once dissected a polype of the vulva as big as a nut, and containing atheromatous substance.

The clitoris and nymphæ are sometimes hypertrophied to such a degree as to require excision. In some countries these structures are naturally much larger than in America and Europe. In Persia and Turkey their development is often very great.

The female urethra is rarely diseased. The principal lesions to which it is liable are, stricture, dilatation, and vascular excrescences. The *stricture* is usually situated at the extremity of the tube, and may be so great as to produce much difficulty in making water. Sir Benjamin Brodie has described a case where the urethra was so much contracted that it scarcely admitted the finest probe: the stricture commenced at the extremity of the canal, and extended about half an inch back. In some congenital malformations, the orifice of the urethra opens into the vagina at some distance from the external aperture. Occasionally, where the mouth of the vagina was closed up by a dense membrane, the urethra has been known to be dilated to such an extent as to admit the male organ.

*Vascular excrescences* sometimes spring from the female urethra, or are seated around its orifice. They are of a bright scarlet color, exquisitely sensitive under pressure, and of a soft, spongy, erectile structure, with a smooth, fissured, or granulated surface. The shape is generally pear-like, and the size varies from a small pea to that of a horse-bean. This disease has been observed in young girls under seventeen, but is most common in adults. The causes which lead to its production are unknown.

In the female, the parts most commonly attacked with *chancre* are, the edges of the pudendal lips, the nymphæ, and the orifice of the vagina. In some instances the disease affects the perinæum, the interior of the vagina, and even the mouth of the uterus. The ulcers exhibit the same characters as when seated on the penis; generally, however, their number is greater, and they are apt to produce more extensive devastation.

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## SECTION V.

### OF THE MAMMARY GLAND.

The mammary gland is situated in front of the great pectoral muscle, nearly equi-distant between the breast-bone and the arm-pit, in the midst of a con-

siderable quantity of adipous substance. In its size it varies very much in different individuals, as well as in the different periods of life. Until the age of puberty, it is always remarkably small, and exists only, so to speak, in a rudimentary state ; but, from this time on, it rapidly augments in volume, and attains its maximum development during pregnancy and lactation. When the period of child-bearing is past, the gland gradually diminishes in size, and is ultimately transformed into a soft, drab-colored substance, in which it is impossible frequently to distinguish any of the primitive tissues.

Divested of the fatty matter by which it is surrounded, the adult mammary gland is of a circular shape, convex in front, but flattened posteriorly, from three to five inches in diameter, and from ten to fifteen lines in thickness. It is of a light pink color, and of a remarkably tough consistence, being cut with more difficulty than fibro-cartilage. Like the pancreas, which in many of its features it closely resembles, it is composed of an assemblage of lobes of different sizes, which are connected together by dense cellular substance, and which impart to the surface of the organ its rough and knotty character. These lobes are more abundant, as well as more intimately cemented together, at the centre than at the periphery of the gland, and they are always rendered very conspicuous when affected with inflammation. By dissection, each can be shown to consist of a series of smaller masses, which are themselves resolvable into granules not bigger than a poppy-seed. These little bodies, the number of which is very great, are very distinct during lactation, and are made up of oblong vesicles, which can only be seen by the aid of the microscope.

From the minute granules that compose the mammary gland, fine excretory tubes arise, which unite together and form the lactiferous ducts. Of these there are commonly from fifteen to twenty : they are tortuous, extensible, semi-transparent, and composed each of two distinct tunics, the external of which is fibrous like that of the ureter ; the internal, mucous : they proceed in a radiated manner from the circumference towards the centre of the organ, and, as they approach the base of the nipple, they all become sensibly expanded, forming so many little sinuses, of a conical shape, the largest of which are more than the sixth of an inch in diameter. All these ducts are destitute of valves, which accounts for the facility with which they can be injected in the backward direction. It was formerly thought by many respectable anatomists that these canals freely communicated with each other ; but more recent investigation has disproved the opinion, it being clearly ascertained that each tube is connected with its proper branches only.

The part in which the lactiferous ducts terminate is called the *nipple*. This projects from the central portion of the anterior surface of the gland, in the form of a conical eminence, the volume of which is liable to great variation, being scarcely alike in any two subjects. Of a light rosy tint, it is firm, elastic, and susceptible of temporary erection, like the penis and the clitoris ; externally it is rough, somewhat reticulated, and furnished with numerous papillæ ; on making a section of it, it is found to be composed mainly of the extremities of the lactiferous ducts supported by bloodvessels and cellular substance. The skin, for a short distance around the base of the nipple, is extremely soft and delicate, of a rosy color in virgins, but of a dark brown in those who have borne children, and provided with several zones of sebaceous follicles.

The mammary gland receives a large supply of vessels, which are always very capacious during lactation. Its nerves are branches of the intercostals and of the brachial plexus. The lymphatics, which are numerous and arranged into two sets, a superficial and deep, terminate in the axillary ganglions ; a circumstance which explains the great facility with which these bodies become enlarged whenever there is any serious lesion in the mammary gland.

This body exists in the male, but only in a rudimentary state. Nevertheless, there have been instances in which it was quite large, and even secreted considerable quantities of milk. It has also been known in a few rare cases to be affected with carcinoma in the same sex.

Occasionally, though very rarely, there is a supernumerary mamma, situated either in front of the chest, near the axilla, on the back, or on some other part of the body. Dr. Roberts,\* of Marseilles, recently reported a case in which, in addition to the ordinary glands, a third occupied the left groin, and served to suckle several children. Examples of quadruple mammæ have been observed by J. F. Lynceus, J. Faber,† Champion,‡ Robert Lee,§ and other physicians. In the latter case the supernumerary breast was situated near the anterior margin of the axilla, and was about one-sixth the size of the other, from which it was separated by a deep oblique depression. The nipple was small and flat, but when gently pressed yielded a milky fluid. Only one case has been recorded of five mammæ in the human subject.|| In some women only one breast has been developed. Supernumerary nipples, capable of furnishing milk, are by no means uncommon.

The lesions of the breast may be arranged under the following heads: inflammation, hypertrophy, atrophy, neuralgia, scirrhus, encephaloid, colloid, melanosis, tubercle, hydatids, serous cysts, fibrous transformation, apoplexy, milky accumulations, fistula, earthy concretions, and erectile tumors.

*Acute inflammation* of the mamma most commonly occurs during lactation, being rarely observed at any other period. It usually sets in within the first week or two after parturition, from the effects of cold, or from an obstruction in some of the lactiferous tubes. The gland is tumid, hard, and engorged with blood, all its vessels being deeply injected. At first there is merely tenderness on pressure; but, in the progress of the disease, the patient complains of severe pain, generally of a sharp, pricking kind, which shoots along the corresponding axilla, and sometimes even along the whole of the upper extremity.

After this state of things has continued for a week or ten days, the disease either stops, passes into the chronic form, or leads to *suppuration*. When the latter event is about to happen, all the symptoms become suddenly aggravated; there are deep-seated, throbbing pains, with excessive tenderness on pressure; the skin becomes red and injected; and the patient suffers under great constitutional irritation, accompanied by alternate chills and flashes of heat. The matter usually collects in one or more abscesses, and is of a thick, cream-like aspect, with a slight mixture occasionally of milk, serum, or blood. The quantity of pus seldom exceeds five or six ounces; in some cases, however, I have known it to amount to several quarts. The time required for the matter to work its way to the surface, varies from ten to twenty days, according to the depth at which it is situated, and the irritability of the constitution. When several abscesses exist, they sometimes communicate together by fistulous tracts.

*Chronic inflammation* of the breast, although it may occur at any period of life, is most common between the ages of seventeen and thirty. Invading usually only one or two lobules, it sometimes attacks the whole gland, the substance of which has a peculiar doughy feel, like that of a fatty swelling, and appears to consist of a number of nodules, from the size of a currant to that of a filbert;

\* Journal Général de Médecine, t. i., p. 57.

† Voigtel, Handbuch der Path. Anatomie, vol. i., p. 569.

‡ Dict. des Sciences Médicales, t. xxxiv., p. 527.

§ Medico-Chir. Trans. of London, vol. xxi., p. 266.

|| Dict. des Sciences Médicales, t. xxxiv., p. 529.



its color is generally a pale yellow, sometimes pink ; and its consistence firm and dense, almost fibro-cartilaginous. This disease often continues for years ; but, what is remarkable, it rarely manifests a malignant tendency, or disposition to suppurate. On pressure, the part is hard and painful, and there is commonly a gnawing uneasiness in it, which is almost always aggravated about the catamenial period. The breast sometimes becomes greatly enlarged in this disease, and causes so much inconvenience as to require removal. Hey mentions a case of this kind, where the organ weighed upwards of eleven pounds, and yet exhibited no structural lesion. I once saw the gland amputated, under the supposition that it was carcinomatous.

*Hypertrophy* of the mamma is by no means uncommon, nor is it, as might be supposed, confined entirely to the female sex. In several instances I have seen both breasts of the male enlarged many times beyond their usual bulk, and not a few cases are recorded where they have freely, and for a long time secreted milk. In women, the swelling is commonly associated with amenorrhœa, but sometimes it occurs during pregnancy, and disappears soon after delivery. One of the most extraordinary examples of hypertrophy of the mamma, perhaps, to be found on record, has been recently reported by Dr. S. C. Houston, in the fourteenth volume of the American Journal of the Medical Sciences. The subject was a colored girl, aged sixteen, who died in the Philadelphia Almshouse, in April, 1834. The left breast, which began to enlarge much earlier than the right, weighed twenty pounds, and measured forty-two inches around the base, forming an oviform mass, which extended from the lower part of the neck to some distance beneath the umbilicus. The other breast, which was of the same shape as the left, was also enormously enlarged ; yet, notwithstanding this, it was perfectly sound, presenting not the slightest structural lesion. Around both glands, the cellulo-adipous tissue was in a state of hypertrophy, and in neither could there be detected any trace of the nipple. The girl had menstruated, and enjoyed good health, until a few weeks before her death, which was occasioned by a contusion of the left mamma, terminating in gangrene. A laced jacket was worn, to sustain the weight of the enlarged organ.

Hey, in his *Practical Observations on Surgery*, alludes to several cases of a similar nature, in all of which the hypertrophy was connected with suppression of the menses ; in one of these, the breast weighed fifteen pounds, and so greatly incommoded by its bulk that it was obliged to be amputated. Dorsten, a German physician, attended a young lady in whom the enlargement was associated with retention of the milk. Both breasts were pendulous and painful, and the left was found to weigh sixty-four pounds. No decided structural change could be detected in the gland, except the mere hypertrophy of the integrant cellular texture.

*Atrophy* of the mamma is the natural effect of old age. When the menstrual function ceases, the gland begins to diminish in volume, and the wasting gradually progresses until at length the whole organ is reduced to a soft, flabby mass, of a dirty greyish tint, in which it is often difficult to detect any of the natural structure, except the lactiferous ducts, which are seldom completely effaced. Sometimes the gland shrinks early in life, particularly in married females who do not nurse their offspring. Temporary atrophy of this viscus results occasionally from the effects of neuralgia, either of the nerves of the face, the trunk, or of the extremities ; and, from the observations of Professor D'Outrepoint, of Würzburg, the same change, it would appear, is often induced by the extract of hemlock, exhibited during lactation.

*Neuralgia* of the breast may occur at any period after puberty, but is most common in young females from the age of fifteen to thirty. It is characterized

by exquisite pain, darting through the part like electricity, and extending generally to the corresponding shoulder and axilla, sometimes down the elbow to the fingers. The suffering resembles that of *tic-douloureux*, observes often a regular periodicity, is very much increased prior to menstruation, and is sometimes so severe that the patient is unable to lie upon the affected side, or bear the weight of the bed-clothes. The disease, although it may last for years, has no malignant tendency: it is met with mostly in persons of a nervous, irritable temperament, and is frequently produced by external injury, such as a blow or contusion. The menstrual secretion is generally very deficient, and there is almost constantly leucorrhœa.

The complaint, although it sometimes affects the whole gland, is most commonly confined to several of its lobules, which either retain their natural bulk and appearance, or they are converted into small, solid tumors, distinctly circumscribed, movable, and highly sensitive to the touch, the pain that is induced by handling them continuing in some cases for several hours. Occasionally these swellings seem to be seated in the connecting cellular tissue, rather than in the glandular structure; they seldom exceed the size of a marble, an almond, or a walnut; they never suppurate, and they sometimes disappear spontaneously. The nature of this disease is still involved in obscurity, a circumstance which is not at all surprising, when we reflect how little we know concerning neuralgia in general.

*Scirrhus* of the breast rarely appears under the age of thirty-five. It is most frequent about the period of the decline of the menses, and is witnessed quite as often in old maids as in women who have borne children. When inspected after death, the mamma is found to be inelastic, firm, dense, and crisp, like cartilage, which it also resembles in color: sometimes it is of a dry, fibrous texture, like the interior of an unripe pear, and of a light greyish tint, interspersed with yellowish lines, probably the remains of lactiferous ducts: more rarely the organ is soft and succulent, presenting a considerable number of small vessels, and yielding, upon pressure, a thin, opaque, serous fluid, occasionally blended with milk. These appearances frequently occur together, forming so many zones, gradually and insensibly running into each other. In some instances, again, the tumor contains one or more cavities, filled with purulent matter, or with a viscid, ropy fluid, not unlike the synovia of the joints.

The malady usually commences in a few lobules (Fig. 243); but, as it progresses, the whole organ becomes converted into a firm, solid mass, with a rough, tuberculated surface. In a scirrhus breast in my pathological collection, removed from a widow lady, thirty years old, there are four or five tumors, the largest of which, hard and crisp, like cartilage, and of an oblong, spherical shape, scarcely equals the size of a pullet's egg. Before the gland was extirpated, it had an irregular, knobby feel, and could be freely moved in different directions. When the whole of the breast is not involved, the excepted part is generally somewhat changed in its color and consistence, being

Fig. 243.





yellowish, firm, and coarsely granulated, so as to resemble the substance of the pancreas.

Beginning usually with slight swelling, the disease is soon followed by sharp, darting pains, accompanied by a peculiar tension and fulness of the mamma. After some time, a circumscribed lump is perceived, hard and irregular to the touch, and somewhat tender on pressure. The induration gradually augments; and, as the turgescence spreads, the whole gland becomes firm, and knobby: in this stage, the organ is still movable, but by degrees it contracts adhesions to the pectoral muscle, so that it can no longer be pushed about with the hand. In the mean time the nipple is painful and retracted; the skin is puckered and discolored; the superficial veins enlarge, and assume a deep bluish tinge, from the obstacle to the return of the blood; the patient loses her flesh; the appetite diminishes; and the strength rapidly declines. Ulceration now sets in, leaving one or more circular sores, with hard, depressed, angry-looking edges, and a foul, sloughy base. The discharge is thin, ichorous offensive, and often so acrid as to corrode the healthy skin. With this state of the disease, the constitution always deeply sympathizes; the woman is harassed with sharp, lancinating pains, darting into the axilla of the affected side, and down the arm; and the irritation now rapidly extends to the neighboring lymphatic ganglions, which either become white, firm, and tumid, or they are rendered preternaturally soft and vascular, having often a bloodshot appearance.

Although scirrhus generally commences in the glandular structure of the mamma, yet occasionally its primitive seat is in the common integuments, and in the surrounding cellulo-adipous tissue. In the first case it usually presents itself in the form of a small rounded tubercle, scarcely larger than a shot, of a bluish color, firm, superficial, movable, and free from pain. This gradually increases in size, and finally involves the glandular structure; the skin in the mean time becoming hard, discolored, and intimately adherent to the subjacent parts. In the other variety of the disease, a firm, oblong, or spherical lump, of considerable volume, is from the first felt deeply embedded in the adipous tissue around the organ, with which it has apparently as yet no connection. It may be readily lifted away with the thumb and finger, but it soon contracts adhesions, gradually contaminates the adjacent structures, slowly approaches the surface, and at last breaks out into a foul, irritable, fungous ulcer.

Scirrhus of the breast frequently remains indolent for a considerable length of time, when it rapidly assumes the characters that have just been assigned to it. When removed, it is almost sure, after an interval of several months or years, to return either in the cicatrice, or in the contiguous lymphatic ganglions. The disease has been known to occur in four or five members of the same family, and in very many cases it coexists with scirrhus in other parts of the body, either alone, or conjointly with encephaloid, melanosis, colloid, or tubercle. In a few instances it has been observed in the male.

Excepting the testis, the eye, lymphatic ganglions, and maxillary sinus, there is probably no organ in the body so frequently affected with *encephaloid* as the mammary glands. Its anatomical characters here are not different from what they are in other parts of the body. The tumor is seldom very uniform in its structure, but is generally very hard in some parts; soft, spongy, and elastic in others. It not unfrequently happens that one portion is fibro-cartilaginous, another pulpy and brain-like, and a third perhaps hæmatoid or cystiform. Cavities or cells, containing different kinds of fluids, are often interspersed through it. Large clots of blood, sometimes of a black, brownish, or yellowish buff-color, and of varying degrees of consistence, are also sometimes met with. The tumor has no capsule, except what is derived from the surrounding cellular tissue, which is occasionally considerably condensed; its



surface is rough and lobulated; and its substance is usually pervaded by numerous vessels, many of them of large size. Hence, the frequent and exhausting hemorrhages after ulceration has commenced. The volume which the tumor attains varies, in different cases, from a fist to a man's head.

The disease may occur at any period after puberty, but is most common after the thirtieth year. Sir Astley Cooper once met with it at the age of twelve. It may generally be easily distinguished from scirrhus by the rapidity of its growth, by the extraordinary volume of the tumor, by the natural state of the nipple, by the varicose enlargement of the subcutaneous veins, by the comparative want of pain, and by there being less disease, in the early stage of the complaint, in the adjoining lymphatic ganglions. The malady usually coexists with encephaloid, tubercle, or scirrhus in some of the other organs.

*Colloid*, alveolar, or gelatiniform cancer rarely attacks the breast. Very few cases of it, indeed, are upon record. The tumor grows rather slowly, and seldom exceeds the volume of the fist or of a foetal head. Externally, it is of a light-greyish color, dense, firm, glistening, and irregularly lobulated; internally, it is comparatively soft and succulent, yields some moisture on pressure, and tears into hard, jelly-like strings. The cellular arrangement, so well-marked in alveolar cancer of the stomach, is seldom very distinct in the breast.

A very rare affection of the breast is *melanosis*, which may occur either as an infiltration amongst the granules of the gland, or, as is more frequently the case, in the form of small spherical nodules, of a black, sooty color. Of this disease, I saw an interesting specimen, some years ago, in an old female who died of pulmonary phthisis, accompanied by scirrhus of the left mamma. The little tumors, which were five in number, were distinctly encysted, and contained a thin, ropy fluid, of the color and consistence of China ink.

*Tubercles* of the breast are also very infrequent. When existing in this organ, it is presumable that they would present the same appearances as in other parts of the body. They are seldom numerous, and they are most commonly found in connection with tubercles of the lungs and lymphatic ganglions.

*Hydatids* very seldom infest the mammary gland. In the examination of a large number of breasts I have not met with a single example. Varying in size between a currant and an orange, they generally invade the entire gland, the proper substance of which they often completely destroy. As in other parts of the body, they occasionally occur in clusters, but in many cases they are perfectly distinct from each other, and of a globular figure. When these bags are of considerable size, it is not uncommon to find within them smaller hydatids, hanging by narrow foot-stalks, and having precisely the same configuration and structure. The contained fluid is either thin and limpid, like spring-water, or thick and glairy, like the white of egg. Sometimes there is an admixture of blood, pus, curdy matter, or particles of inspissated lymph. Hydatids usually occur in connection with carcinoma, and they occasionally attain the volume of a foetal head, though generally, as before stated, they are much smaller. When they are large and numerous, the breast will sometimes weigh eight or ten pounds. Tumors of this kind have not always a malignant tendency; oftentimes they cause little or no suffering, and if, after their contents are discharged, their sides be brought into contact, they will frequently unite by adhesive inflammation.

Tumors of the breast, containing serous cysts, of a structure much more simple than that of the true hydatid, have been described by a great number of pathologists. The disease constitutes what is called *cystic sarcoma*, and the vesicles producing it are developed in the interlobular cellular tissue of the gland.

They are of a spherical figure, and vary in size between a hemp-seed and a marble. Sometimes they attain the volume of a hen's-egg, an orange, or even a foetal head. Their number ranges from one to several hundred. At an early period they are smooth, transparent, elastic, vascular, closely adherent, and filled with a clear, watery fluid, slightly saline in its taste, and scarcely coagulable by heat, alcohol, or acid. Their parietes, however, are liable to become opaque and thickened, from the effects, probably, of inflammatory irritation, and the same cause generally induces remarkable changes in the contained fluid, which may be lactescent, bloody, oleaginous, glairy, or gelatinous. Different cells of the same tumor often have dissimilar contents. The morbid mass is sometimes entirely composed of cysts; at other times a considerable proportion of solid matter is interposed between them, and this commonly possesses a tough, cellulo-fibrous character.

The cystic tumor often acquires a large bulk. It is most common in young subjects, is rather tardy in its progress, and is not prone to degeneration, or reproduction after removal. When fully formed, the mammary gland is generally completely annihilated.

The breast, like the testis, is liable to the *fibrous transformation*. The lesion, however, is very infrequent, and is observed chiefly in young, unmarried females. The organ may retain its normal size, or it may acquire a bulk equal to that of an orange, a fist, or even an adult head. The tumor is enclosed by a thin capsule of condensed cellular tissue, is firm and compact, and has a rough, nodulated surface. Occasionally, however, it is perfectly smooth, compressible, and slightly elastic; but these are characters which are not essential to it. Examined with reference to its intimate structure, it is found to be composed of a pale greyish substance, nearly or quite homogeneous, friable, easily crushed, and very similar to that of a hypertrophied lymphatic ganglion. Some parts of it may be so hard as to creak under the knife, and specimens occur, possessing all the properties of old fibrinous concretions. Minute cells, variable in size and number, are occasionally scattered through it. The probability is, that the transformation commences in the interlobular cellular substance of the organ, and that new fibrous tissue is developed, which, by its pressure, causes at first atrophy, and finally total destruction of the glandular texture. The disease is slow in its progress, and free from malignant tendency.

Closely allied to neuralgia of the breast, already described, is a morbid change which occasionally occurs in the breast of young girls soon after the period of puberty. It may be considered as a species of *apoplexy*, as it consists in an effusion of blood into the cellular tissue of the organ, resembling an ecchymosis produced by a blow or leech-bite. Generally there is only one such spot, but there may be as many as five or six: they come on a few days before the menstrual period, and disappear within the first week or two after; though, in some instances, they have been known to continue for more than a month. This disease, first pointed out, I believe, by Sir Astley Cooper, seems to depend upon some sympathetic action between the uterus and the breast, causing great determination of blood to the latter, eventuating in the rupture of some of the smaller vessels. The affected parts, which are always of a dark, livid hue, are exquisitely tender on pressure, the pain sometimes shooting down to the ends of the fingers.

The *lactiferous ducts*, like other excretory canals, are liable to be permanently closed by causes which interrupt the passage of the milk, such as external tumors, or accidental products contained in their interior. Of these the most common by far is the effusion of plastic lymph produced by inflamma-

tory irritation. The extent to which the tube is obliterated varies in different cases, from a few lines to an inch or more. The lesion generally arises within the first month after delivery; and, as the breast is then engaged in secreting milk, the portion of the tube behind the constricted or obliterated part is apt to become dilated, forming a globule, ovoidal, or pear-shaped tumor, the volume of which rarely exceeds that of an orange.

The swelling is almost always attended with a peculiar sense of distention, and distinctly fluctuates under the finger. On cutting into it the contents are found to be of a whitish color, and of the consistence of milk, cream, or whey; the quantity ranging from a few drachms to several ounces.

A very interesting case of this disease is reported by my friend, Professor Parker, in the New York Medical Gazette, for January, 1842. The subject, who had always enjoyed good health, was thirty years of age, and the mother of five children, the youngest nine months old. The swelling occupied the right breast, and was first noticed about three months after her confinement. Not less than three quarts of milk were evacuated at the first operation; in a week it had reaccumulated to the amount of three pints. A still more remarkable instance is mentioned by Scarpa,\* of a young female, whose left breast, after her second confinement, in the course of two months acquired such a size that it measured thirty-four inches in circumference, and rested, when she was sitting, on the corresponding thigh. The skin presented no particular alteration, except that it was rather tense and shining, the subcutaneous veins being dilated. A flow of pure milk followed the introduction of the trocar, and ten pints of that fluid were drawn off in a continuous stream.

Under the name of the *butter-like tumor*, Velpeau† has given an account of a disease which evidently belongs to the class of swellings just described. He met with it in the right breast of a woman, about forty years of age, otherwise in good health, and having nursed several children. The tumor was indolent, hard, with marked nodosities, of the size of two fists, movable, and unaccompanied with discoloration of the skin. It was essentially composed of a yellow, firm, concrete substance, of the appearance of cheese, butter, or coagulated caseum, and contained in the flattened and altered interlobular cellular tissue of the gland. Under the microscope it presented a multitude of globules analogous to those of milk, soluble like them in æther and alcohol, insoluble in ammonia, and interspersed with the mucous globules, and granular corpuscles of the colostrum. The disease, which had been first observed eight months ago, in connexion with lactation, promptly reappeared after extirpation, in the unclosed cicatrice, in the form of a little cluster of tumors, which in four months attained the size of an infant's head.

It is not improbable that the milk in this disease is poured out into the connecting cellular tissue of the gland, either as a secretion, or as a consequence of the rupture of some of the lactiferous ducts. The opinion, at all events, derives support from the cases published by Siebold, Moore, Lee, and Stanley, in which this fluid was found in the axilla.

During lactation a galactophorous duct is sometimes included in a wound of the breast, and, unless the edges of the integuments be very closely approximated, a true *fistula* may remain in the part. The same consequences may be produced by a rupture of the canal from the inordinate accumulation of milk. A more common occurrence is the formation of accidental outlets, from the

\* American Medical Recorder, vol. ii., p. 472.

† Diseases of the Breast, Translated by Dr. Parkman, p. 56. Phila. 1841.



irritation of multilocular abscesses. These passages are often of considerable depth, tortuous, numerous, and exceedingly difficult to heal, owing to the fact that they are generally lined by an adventitious membrane, and attended with a great deal of induration of the surrounding parts.

*Calcareous concretions* are occasionally met with in the breast, either in its substance or the lactiferous ducts: they are commonly small, not exceeding an ordinary pea, and hitherto they have been observed chiefly in connection with encephaloid and scirrhus. Sir Astley Cooper supposes that these concretions are the result of a process similar to what takes place in the formation of natural bone; that this is occasionally the case, seems to me not improbable, but I am far from believing that it is of uniform occurrence. I have seen these bodies only in two instances, in females far advanced in life. They were of a whitish color, irregularly spherical in shape, and of a hard, solid consistence, like dry mortar.

*Erectile tumors* are sometimes found about the mamma, attaining occasionally a very large size. They are soft, exceedingly vascular, of a dark florid color, and liable to bleed on the slightest touch. Composed essentially of an interlacement of arterial and venous branches, they are most common in adult females, though in a few instances they have been noticed in the male.

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## SECTION VI.

### DISEASES OF THE PLACENTA.

The placenta is a soft, spongy, vascular organ, serving as a bond of connection between the mother and the fœtus. When fully developed, its weight is about twelve ounces. It is nearly circular in its form, from six to eight inches in diameter, and about eighteen lines thick at the centre, from which it gradually decreases towards the circumference. When divided, it is found to be essentially composed of the ramifications of the umbilical vessels, which are distributed in all directions, connected together by cellular substance, and intersected by fibrous filaments, giving the whole the aspect of a parenchymatous structure. Of the two surfaces of the placenta, the fetal is perfectly smooth and polished, being invested by a reflection of the chorion and amnios; the uterine presents a considerable number of lobules, technically named cotyledons, and is covered by a soft, cellulo-fibrous lamella, known under the name of the deciduous membrane. In their shape, the lobules are irregularly rounded, and they each receive an arterial and venous branch, which ramify through its substance, but do not anastomose with the vessels of the adjoining masses. Neither nerves nor absorbents have been satisfactorily traced into the placenta, though the probability is that both exist there.

When we consider that the placenta is a species of organized pseudo-membrane, it is not surprising that, notwithstanding its temporary existence, it should be liable to various morbid alterations. Until recently this subject appears to have attracted very little attention; Morgagni and some of the older anatomists have, it is true, transmitted to us some interesting cases of diseases of the placenta; but they are, for the most part, so loosely drawn up as to render it extremely difficult to deduce from them any thing like general principles. The most important facts of which we are at present in possession have been furnished by Professor Cruveilhier, of Paris, Monsieur Brachet, of Lyons, and Dr. Simpson, of Edinburgh. The researches of these pathologists are of

the greatest value, not only to morbid anatomy, but to medical jurisprudence, a branch of science upon which they have the closest bearing. The most common diseases of the placenta, and those which will be briefly noticed on this occasion, are inflammation, atrophy, cartilaginous degeneration, ossification, and sanguineous effusions.

Acute *inflammation* of the placenta is extremely rare ; at any rate, such must be our conclusion when we reflect upon the few cases of it that are to be found on record. The disease is generally limited in its extent, and appears to terminate in one of three ways, — either in the effusion of lymph, in suppuration, or, finally, in passing into the chronic form. In the first case, the affected part presents all the characters of a hepatized lung ; that is to say, it is dense, solid, easily crushed, and of a dark reddish color. When the lymph is poured out between the inner surface of the organ and the corresponding portion of the uterus, the two structures become so intimately incorporated, as to render it frequently impracticable, when the period arrives for their separation, to detach them from each other. In this way, there is reason to believe, usually arises what is called morbid adhesion of the placenta.

*Suppuration* of the placenta is extremely rare, and I have never met with an instance of it. The matter is commonly confined to one or more cotyledons, and is either diffused through their substance, or collected into one or more abscesses. In a case recorded by Brachet, not less than fourteen depôts were found, varying in volume between that of a pea and a nut. The pus was of a thick consistence, without any particular odor, and looked a good deal like softened tubercular matter.\*

Another lesion which is sometimes observed is *softening*. How far this is dependent upon inflammatory irritation is a point which has not been determined. I have noticed this condition in quite a number of cases, in several of which it was associated with the fibro-cartilaginous and osseous degenerations presently to be described. Occasionally the softening appears to affect the entire organ ; but, in the majority of instances, it is confined to particular sections of it, occupying one-fourth, one-third or one-half of its extent. The volume of the placenta is seldom altered in this lesion.

The most common disease of the after-birth is the *cartilaginous degeneration*. This generally occurs in small, circumscribed masses, from two to four lines in thickness, of a whitish, milk-like color, and of an irregularly oval shape. In their consistence, they vary from the softness of fibrous texture to the density of articular cartilage. In some instances, they are of a pale yellowish color, and partially transformed into osseous matter. In other cases, though this is not common, the masses are intersected by fibrous bands, constituting that form of the disease to which the older anatomists have applied the term *scirrhus*. In a third series of cases, the affected part has a remarkably granular appearance, being composed of an infinity of small, spherical bodies, of a reddish buff color, dense and firm in their consistence, and scarcely exceeding the volume of a millet-seed. This degeneration is generally associated with atrophy, and, as might be supposed, interferes more or less with the nutrition of the fœtus.

Another rather frequent lesion of the placenta is *ossification*. Of this I have observed several well-marked examples. The degeneration may occur under two varieties of form. In one, the more frequent of the two, the ossification is confined exclusively to the smaller arterial branches, which assume an acicular arrangement, hundreds of them sometimes existing in a space not exceeding half a square inch. They are of a yellowish color, fragile, and particularly

\* Journal Générale de Médecine, 1828.

conspicuous at the uterine surface of the organ. In this way whole cotyledons are occasionally transformed. This species of degeneration, which sometimes pervades the entire placenta, is analogous to senile ossification of the arteries. The larger arterial branches usually remain sound, and the bulk of the organ is seldom materially diminished.

In the second variety, the foreign matter occurs in the form of a distinct layer, varying in thickness from the fourth of a line to a quarter of an inch. In its diameter, it rarely exceeds a cotyledon, to the inner surface of which it closely adheres, the deposition commencing apparently in its cellulo-fibrous envelope. In some instances, these plates are partly osseous, partly cartilaginous, and partly fibrous, according to the length of time they have been in progress of forming; their number is occasionally considerable; and they have been known to constitute a complete shell, accurately moulded to the uterine surface of the organ. A radiated arrangement is sometimes observable in these plates, not unlike that of the parietal bone of the fœtus, the osseous fibres extending from the centre to the circumference. The deposit consists, according to the analysis of Ficinus,\* of albumen, fibrin, phosphate of lime, phosphate of magnesia, carbonate of lime, and sulphuric acid.

Like other organs of the body, whose existence is of a less temporary nature, the placenta is liable to *hypertrophy*. When this happens, the weight and bulk of the viscus are considerably augmented, sometimes enormously; its color is abnormally pale; the parenchymatous structure is infiltrated with serosity, pits on pressure, and is often uncommonly firm. This lesion is rare, and its history is still imperfect.

Tubercles of the placenta are exceedingly rare; at all events very few examples of this disease have been recorded by writers. It is usually associated with pulmonary phthisis, and the heteroclite deposit is dispersed through the parenchymatous substance of the organ, in small discrete masses, of a pale straw color, and almost fibro-cartilaginous consistence. In a case mentioned by Roche† the placenta contained five or six bodies of this kind as big as small nuts, the female was in the last stage of phthisis when she became pregnant, and the child, which was born at the full term, was remarkably thin and delicate, and died at the age of six months, having been harassed with a cough from its birth.

The placenta, finally, is sometimes the seat of *sanguineous effusions*. Several such cases have occurred in my own practice, and not a few are recorded by authors. The blood is poured into the parenchymatous substance of the organ, near its uterine surface, in the form of irregular masses, varying in volume between a pea and a walnut. The number of dépôts is usually small, though, in a few rare instances, every cotyledon has been affected. The fluid, at first of a dense modena color and of a soft consistence, becomes gradually lighter and more dense, until finally it presents all the properties of an old apoplectic effusion of the brain. The surrounding textures are generally more or less altered, and many of the vessels are plugged up with fibrin. This lesion is occasionally connected with the fibro-cartilaginous degeneration.

Nearly all the lesions above described are either directly hostile to the persistence of the placenta, or they interfere, to a greater or less extent, with the nourishment of the fœtus. In the cartilaginous and osseous transformations, many of the vessels are either entirely obliterated, or their calibre is so

\* American Med. Recorder, vol. xiii., p. 425.

† Dict de Méd. et de Chir. Prat., t. xiii., p. 46.



much diminished as to admit of a very imperfect circulation. Hence, atrophy of the placenta, and emaciation of the new being. When the lesions are extensive, abortion is the consequence. Ossification of the placenta occurs occasionally in several successive pregnancies.

The placenta may adhere to any part of the uterus, but is usually found at the base. In twin cases, it is either double, bilobulated, or furnished with two cords. Occasionally it is attached to the head of the infant.\*

The *umbilical cord* presents some anomalies worthy of brief notice. It is occasionally double, and cases are recorded where it was inserted into the head, chest, and extremities. The length of the cord at birth is generally about twenty inches; but it may be much longer. In one instance I found it four feet and a half, and in another, mentioned to me by Dr. Catlin, of Massachusetts, it was nearly six feet. Its veins are sometimes varicose; it is occasionally twisted, knotted, or tuberculated; and, in a few rare instances, it has presented black nodosities, or been partially filled with hydatids. Blandin, Velpeau, and others, narrate cases where there was but one artery and two veins, instead of two arteries and one vein.

\* Nouv. Bibliothèque Méd. 1830.



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